CLAIMS

[Claim(s)]
[Claim 1] The 1st member which is the lens driving gear equipped with the lens and the driving means driven so that this lens may be moved in the predetermined direction, and holds a lens, It has the 2nd member which holds said 1st member through two or more elastic support members prolonged in the same direction. Said two or more elastic support members [while carrying out elastic deformation, permitting migration of said lens, and resulting / from the 2nd member / in the 1st member, respectively, when driving force is given by said driving means] The lens driving gear characterized by having the 1st flection crooked towards the 1st direction, and the 2nd flection crooked towards the 1st direction and the 2nd direction which intersects perpendicularly mostly.
[Claim 2] Said 2nd direction is a lens driving gear according to claim 2 characterized by being the direction which intersects perpendicularly with both sides with the direction where said 1st direction is a direction parallel to the optical axis of said lens, and said 1st direction and said elastic support member are prolonged.
[Claim 3] The 1st and the 2nd flection of each of said elastic support member are a lens driving gear according to claim 1 or 2 characterized by being covered with the damper member.
[Claim 4] Said damper member is a lens driving gear according to claim 3 characterized by consisting of a gel raw material.
[Claim 5] Said the 1st and 2nd flection in each elastic support member are a lens driving gear given in either of claims 1-4 characterized by being prepared in the almost same location in the direction in which the elastic support member concerned is extended.
[Claim 6] The 1st flection and 2nd flection in each elastic support member are a lens driving gear given in either of claims 1-5 characterized by absorbing the oscillation produced by the interaction in the direction where the elastic support member concerned is extended, and all the directions that intersect perpendicularly.
[Claim 7] It is a lens driving gear given in either of claims 1-6 to which said principal plane of each part which two or more elastic support members of a book are tabular [of the Sai chief], respectively, and contains said those flections is characterized by being arranged in the condition that it becomes in parallel with the specific direction of 1 which intersects perpendicularly with the direction where the elastic support member concerned is prolonged.
[Claim 8] Said specific direction of 1 is a lens driving gear according to claim 7 characterized by being the same direction as said 2nd direction.
[Claim 9] Said the 1st member and 2nd member are a lens driving gear given in either of claims 1-8 characterized by coming to be fabricated by injection molding as the connection part of each of said elastic support member which should be connected with each is embedded inside.
[Claim 10] The optical pickup which is an optical pickup equipped with the semiconductor laser component, the lens driving means which drives the lens which condenses the laser beam injected from the semiconductor laser component to the information recording surface of an optical recording medium in the predetermined direction, and the photo detector which receives the reflected light from an optical recording medium, and is characterized by using the lens driving gear of a publication for either of claims 1-9 as said lens driving means.
[Claim 11] Said semiconductor laser component and photo detector are an optical pickup according to claim 10 characterized by being held where position relation is maintained to a lens to the 1st member in either of claims 1-9.
[Claim 12] It has the structure which consists of the 1st member for holding a lens, and the 2nd member which holds this 1st member through two or more elastic support members. The structure production process which is the manufacture approach of a lens driving gear of making the variation rate of the 1st member carrying out in the predetermined direction to the 2nd member with an actuation unit, and driving a lens, and manufactures said structure, The lens mounting process of attaching a lens in the 1st member of the structure concerned, and the actuation unit mounting process of attaching an actuation unit in said structure are included. Said structure production process The 1st flection which processes plate material and is crooked towards the 1st direction which intersects perpendicularly with the principal plane of said plate material in the middle of the longitudinal direction, The elastic support member preparation process of preparing two or more elastic support members which have the 2nd flection crooked towards the 2nd direction which is parallel to the principal plane of said plate material, and intersects perpendicularly with said longitudinal direction, The manufacture approach of the lens driving gear characterized by including said the 1st and injection-molding process which forms the 2nd member with injection molding as embeds two or more connection sections of said the 1st and 2nd member of the elastic support member of a book, respectively.
[Claim 13] Said elastic support member preparation process is the manufacture approach of the lens driving gear according to claim 12 characterized by including the 1st process which forms a step in the part which is equivalent to said 1st flection at plate material by press working of sheet metal, and the 2nd process which forms the plate material in which this step was formed in the configuration which has the 2nd flection further by die-press processing or etching processing.
[Claim 14] Said elastic support member preparation process is the manufacture approach of the lens driving gear according to claim 12 or 13 by which it is including [where they were mostly arranged by parallel at the predetermined spacing and are connected with a frame in the both ends, while preparing two or more elastic support members]-excision process which

excises said frame after said injection-molding process characterized.
[Claim 15] It has the structure which consists of the 1st member for holding an objective lens, and the 2nd member which holds this 1st member through two or more elastic support members. The structure production process which is the manufacture approach of a lens driving gear of making the variation rate of the 1st member carrying out in the predetermined direction to the 2nd member with an actuation unit, and driving an objective lens, and manufactures two or more said structures, The lens mounting process of attaching an objective lens in the 1st member of each of said structure, and the actuation unit mounting process of attaching an actuation unit in said each structure are included. Said structure production process The 1st flection which processes plate material and is crooked towards the 1st direction which intersects perpendicularly with the principal plane of said plate material in the middle of the longitudinal direction, The elastic support member preparation process which puts in order two or more sets of two or more elastic support members which have the 2nd flection crooked towards the 2nd direction which is parallel to the principal plane of said plate material, and intersects perpendicularly with said longitudinal direction, and forms them, The manufacture approach of the lens driving gear characterized by including said 1st [the] corresponding to [as two or more connection sections of said the 1st and 2nd member of the elastic support member of a group are embedded, respectively] each class, and the injection-molding process which injection molds the 2nd member simultaneously with the metal mold of a lot.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the manufacture approach of the optical pickup used for the account rec/play student equipment of optical which reads information in optical recording media, such as an optical disk, and is reproduced, the lens driving gear used as the body, and the lens driving gear concerned.
[0002]
[Description of the Prior Art] In the lens driving gear used for the optical pickup in the account rec/play student equipment of optical which performs record/playback of the recording information of optical recording media, such as CD (compact disk) and an optical disk of DVD (digital Vaasa tile disk), it is constituted so that the focus which doubles a focus to the information recording surface on an optical recording medium, and the tracking make a focus follow in whose footsteps to the information record train on an information recording surface (truck) may be performed.
[0003] For example, with the account rec/play student equipment of optical of CD, since the CD concerned rotates at high speed (it is 200 - 500 times in 1 minute.), actuation of the objective lens for the above-mentioned focus and tracking will be frequently performed at short spacing, it will originate in the actuation actuation, the resonance frequency of an equipment proper will arise in various frequency regions, and this will have an adverse effect from an optical recording medium on information acquisition.
[0004] So, the structure for controlling resonance of an objective lens in a high-frequency band from a low frequency band is needed for a lens driving gear. The lens driving gear currently indicated by JP,7-105551,A as a conventional example which aimed at such resonance control can be mentioned (the 1st conventional technique). The outline of the lens driving gear 500 applied to the 1st conventional technique concerned at drawing 13 (a) is shown. In addition, only the expedient top of explanation and the fixed side member 507 are shown by the longitudinal section.
[0005] As shown in this drawing, this lens driving gear 500 is held in the state of the cantilever in the movable side member 502 in which an objective lens 501 is carried at the fixed side member 507 through four long and slender elastic support members 503-506 (the supporter material 504 and 506 laps and is not visible to the supporter material 503 and 505 of that this side by a diagram, respectively.). As the connection end face section of each elastic support members 503-506 is buried in the interior of the fixed side member 507, it is filled up with a damper member. The elastic support members 503-506 are curving a little up in the restoration part concerned, respectively, and suppose that the oscillating depressor effect by the damper member will be increased to the gradual oscillation especially in a high-frequency band of an elastic support member by this.
[0006] Moreover, there is a lens driving gear currently indicated by JP,9-7203,A (the 2nd conventional technique). Drawing 13 (b) is the appearance perspective view showing the configuration of the lens driving gear 600 concerning this 2nd conventional technique. As shown in this drawing, this lens driving gear 600 is held in the state of the cantilever in the movable side member 602 in which an objective lens 601 is carried at the fixed side member 607 through four long and slender elastic support members 603-606. Beforehand, in the metaled plate, it is processed so that clinch section 603a on U characters may be formed in a near-side edge by the die press etc., and as for the elastic support member 603, other elastic support members, and 604-606 are processed in the shape of isomorphism.
[0007] The elastic support members 603 and 604 of each upper and lower sides, and 605 and 606 are not parallel respectively, and when it sees from [of drawing] A, they are connected with the movable side member and the fixed side member in the condition of having made it inclining in the direction which intersects perpendicularly with a ******** longitudinal direction so that each cross section may face in the shape of [of Ha] a character mutually. Thus, by leaning a principal plane in the shape of [of Ha] a character, it is supposed that the amount of displacement by oscillation of the elastic support member in the direction of a focus and the direction of tracking can be enlarged, and resonance depressor effect can be enlarged by installing a damper member (un-illustrating) in the clinch section of each elastic support member.
[0008]
[Problem(s) to be Solved by the Invention] However, according to the lens driving gear 500 in the conventional technique of the above 1st, even if it is able to suppress effectively resonance of the longitudinal direction of the elastic support members 503-506, or the vertical direction (the direction of a focus), in addition, the oscillation in horizontally (the direction of tracking) it intersects perpendicularly with them cannot be suppressed effectively.
[0009] Moreover, although each edge fixes according to an individual to the movable side member 502 and the fixed side member 507 where the elastic support members 503-506 are sagged, it is difficult in that case to sag four elastic support members 503-506 in homogeneity. since it will come to be alike that the movable side member 502 is also held in the distorted condition (tilt condition) to the fixed side member 507, and will moreover be alike to that extent for every components, and dispersion will arise, and it is acquisition of exact optical information, it is [be / it / if / those amounts of bows are not uniform,] by no means desirable. If it is going to avoid this, it is necessary to attach one 1 elastic support member, adjusting the amount of bows minutely, and mass production nature will fall to the degree of pole.

[0010] In order to cancel such inconvenience, making mostly the amount of bows of each elastic support member into homogeneity, when it carries out insert molding to them, respectively, as the edge of two or more elastic support members is embedded at the movable side member 502 and the fixed side member 507 is also considered, but unless it can still control the oscillation in the direction of tracking effectively, there is no change. Moreover, in the 2nd conventional example, since it mounts in a movable side member and a fixed side member by the physical relationship from which the cross section of the elastic support member of a vertical couple becomes the shape of Ha's character while preparing the clinch pattern of the shape of U character aiming at resonance control in an elastic support member, it is thought that it is possible not only the direction of a focus but to control the oscillation in the direction of tracking to be sure. However, in equipping with an elastic support member according to an individual also in this conventional example, while a routing counter increases, the problem that dispersion in a property occurs according to deformation of the elastic support member at the time of an assembly etc. arises.
[0011] In order to cancel dispersion at the time of such mounting, when carrying out insert molding of each elastic support member to a movable side member and a fixed side member as one, things are also considered, but since the field where insert molding of the elastic support member is carried out as mentioned above is not parallel to mutual, in the metal mold of a simple vertical horizontal configuration, it cannot realize, but insert molding requires further much division metal mold, and the problem that a process becomes very complicated newly produces it.
[0012] This invention is made in view of the above-mentioned problem, and it aims at offering the optical pickup using the lens driving gear excellent in mass production nature, its manufacture approach, and the lens driving gear concerned while it controls effectively the resonance which reaches a high-frequency band from the low frequency band which produces an objective lens by high-speed actuation.
[0013]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the lens driving gear concerning this invention The lens attachment component which is the lens driving gear equipped with the lens and the driving means driven so that this lens may be moved in the predetermined direction, and holds a lens, It has the pedestal which holds said lens attachment component through two or more elastic support members prolonged in the same direction. Said two or more elastic support members [while carrying out elastic deformation, permitting migration of said lens, and resulting / from a pedestal / in a lens attachment component, respectively, when driving force is given by said driving means] It is characterized by having the 1st flection crooked towards the 1st direction, and the 2nd flection crooked towards the 1st direction and the 2nd direction which intersects perpendicularly mostly. Thus, since the 1st flection and 2nd flection which are crooked towards the direction which intersects perpendicularly in the middle of the longitudinal direction of an elastic support member mutually are prepared, if a damper member is prepared in this part, the resonance in all directions can be controlled effectively.
[0014] Moreover, the lens driving gear concerning this invention is a direction where said 1st direction is parallel to the optical axis of said lens, and since said 2nd direction is made into the direction which intersects perpendicularly with both sides with the direction where said 1st direction and said elastic support member are prolonged, when used as a lens driving gear of an optical pickup, it can control effectively the unnecessary oscillation in the direction of a focus and direction of tracking.
[0015] Furthermore, the depressor effect of resonance is acquired to validity by covering the 1st and the 2nd flection of each of said elastic support member to a damper member. Here, as for said damper member, considering as a gel raw material is desirable. A gel raw material has almost uniform viscoelasticity in all the directions, and fits the damper member. Moreover, if said the 1st and 2nd flection in each elastic support member are prepared in the almost same location in the direction in which the elastic support member concerned is extended, they can lessen the amount of a wrap damper member.

[0016] Moreover, it is characterized by being arranged in the condition that the lens driving gear concerning this invention becomes in parallel with the specific direction of 1 which intersects perpendicularly with the direction where the elastic support member concerned is prolonged by said principal plane of each part which the elastic support member of a book is tabular [of ** length], respectively, and contains two or more said those flections. By this, when carrying out insert molding of the elastic support member to a lens attachment component, a pedestal, and one, horizontal metal mold can be closed from the specific direction concerned of 1, and insert molding becomes very easy.
[0017] And as said lens attachment component and pedestal embed inside said a part of two or more elastic support members which should be connected with each, it comes to fabricate them by injection molding. Thus, since the time and effort which attaches an elastic support member in a pedestal or a lens attachment component according to an individual by fabricating to one by insert molding becomes unnecessary and it is simultaneously attached under uniform conditions, dispersion for every components is lost.
[0018] Moreover, since the above-mentioned lens driving gear is used for the optical pickup concerning this invention, effectiveness equivalent to them is enjoyed, resonance of a lens is controlled, and positive reading/store of the information on an optical recording medium of it are attained. Here, if components, such as a semiconductor laser component in an optical pickup, are held where position relation is maintained to a lens to the above-mentioned lens attachment component, the optical pickup by which an optical precision was stabilized can be obtained.
[0019] Moreover, the manufacture approach of the lens driving gear concerning this invention It has the structure which consists of the 1st member for holding a lens, and the 2nd member which holds this 1st member through two or more elastic support members. The structure production process which is the manufacture approach of a lens driving gear of making the variation rate of the 1st member carrying out in the predetermined direction to the 2nd member with an actuation unit, and driving a lens, and manufactures said structure, The lens mounting process of attaching a lens in the 1st member of the structure concerned, and the actuation unit mounting process of attaching an actuation unit in said structure are included. Said structure production process The 1st flection which processes plate material and is crooked towards the 1st direction which intersects perpendicularly with the principal plane of said plate material in the middle of the longitudinal direction, The elastic support member preparation process of preparing two or more elastic support members which have the 2nd flection

crooked towards the 2nd direction which is parallel to the principal plane of said plate material, and intersects perpendicularly with said longitudinal direction, Said injection-molding process which forms the 1st and the 2nd member with injection molding as embeds two or more connection sections of said the 1st and 2nd member of the elastic support member of a book, respectively is included. Said elastic support member preparation process by press working of sheet metal It is characterized by including the 1st process which forms a step in the part which is equivalent to said 1st flection at plate material, and the 2nd process which forms the plate material in which this step was formed in the configuration which has the 2nd flection further by die-press processing or etching processing.

[0020] Thereby, equipment with little dispersion for every components can be fertilized. Here, if it is made include the excision process which excises said frame after said injection-molding process while said elastic-support member preparation process prepares two or more elastic-support members, where they were mostly arranged by parallel at the predetermined spacing and are connected with a frame in the both ends, since the location of the elastic-support member at the time of injection molding will be stabilized by it, it contributes to prevention of dispersion in equipment further.

[0021]

[Embodiment of the Invention] Hereafter, the gestalt of implementation of the optical pickup concerning this invention is explained based on a drawing.

<the gestalt of the 1st operation> (configuration of an optical pickup) -- the configuration of the lens driving gear in the optical pickup concerning the gestalt of this operation is explained first.

[0022] Drawing 1 is the perspective view showing the configuration of the important section of the lens driving gear 100 concerned. As shown in this drawing, an objective lens 10 is carried in the lens attachment component 20 which is a movable side member, and connection support of the lens attachment component 20 is carried out at the fixed side member 40 through the elastic support section 30 which consists of four elastic support members 31-34 which have conductivity. The fixed side member 40 is further fixed to the optical pedestal 60 (refer to drawing 3).

[0023] The drive coil unit 50 which consists of a tracking coil 52 made to drive in the focal coil 51 which makes the objective lens 10 besides an objective lens 10 drive in the direction of an optical axis (the direction of a focus: Z direction), and the direction (the direction of tracking: the direction of Y) which follows in footsteps to the information record train of an optical recording medium is carried in the lens attachment component 20.

[0024] The connection terminal of each coil is electrically connected with the elastic support members 31-34 in the lens attachment component 20 interior, respectively, and the elastic support members 31-34 can supply an actuation current from the edges 312-342 which projected on the outside of the fixed side member 40 while being formed with a conductive ingredient. Thus, since the elastic support members 31-34 serve as the wiring lead while being lightweight-ized rather than it carries a magnet in this part by carrying a drive coil unit in the lens attachment component 20 side which is a movable side member, in order to energize to a drive coil, the need that direct lead wire is connected and taken about to a drive coil is lost, and it becomes possible to drive the lens attachment component 20 smoothly.

[0025] Flections 311-341 (in drawing 1 , a flection 341 hides and is not visible to the fixed side member 40.) are formed near the end face section by the side of the fixed side member 40 of the elastic support members 31-34. Crevices 41-44 are established in the location applicable to the flections 311-341 of each elastic support members 31-34 of the fixed side member 40, and it fills up with a gel damper member here, and has the structure where the flections 311-341 of ** are buried into said damper member.

[0026] Four flections 311-341 have the structure where come to be crooked towards the 2-way (the Z direction of drawing, the direction of Y) which intersects perpendicularly with the four-directions symmetry, respectively, and this suppresses the resonance in the 2-way concerned certainly. Drawing 2 (a) is a top view when seeing the condition of the flection 311 of the elastic support member 31 in the crevice 41 of the fixed side member 40 of drawing 1 from the upper part (- Z direction), and drawing 2 (b) is a side elevation when seeing this part from Y. In addition, in both drawings, the cross section along a field of explanation which the elastic support member 31 exposes shows the damper member for convenience.

[0027] As shown in both drawings, the predetermined include-angle crookedness of the flection 311 being carried out towards the direction of Y, even if it turns to - Z direction, predetermined include-angle crookedness is carried out, and the perimeter is filled up with the gel damper member 411. This damper member 411 is formed from the silicone porosity matter which consists of mixture of liquefied silicone and a cross linking agent, and since it has almost uniform viscoelasticity in all the directions, it has the outstanding resonance control function.

[0028] If an objective lens 10 is driven at high speed in the direction of a focus (Z direction), and the direction of tracking (the direction of Y) in order to read the information on an optical recording medium to accuracy, as mentioned above, in the specific frequency region in a RF field, resonance will occur from a low frequency field in the lens attachment component 20. In the resonance in a low frequency field, the resonance mode which serves as a fundamental wave and vibrates to the longitudinal direction of the elastic support members 31-34 occurs, and high order resonance mode occurs in the resonance in a RF field.

[0029] Since the high order resonance mode in a RF field is mainly produced in the die-length direction of the elastic support member 31, by preparing a flection as shown in drawing 2 (a) and (b), the amount of displacement of the die-length direction and the direction which intersects perpendicularly becomes large, and positive resonance depressor effect is acquired according to the resonance depressor effect of the viscoelasticity member with which the crevice 41 was filled up. Moreover, also in a low frequency field, since not only the direction of a focus but the direction of tracking and the 2-way are made crooked, the amount of displacement in the viscoelasticity member in both directions can increase, and, thereby, resonance depressor effect can be increased.

[0030] Drawing 3 is drawing of longitudinal section showing the configuration of the optical pickup 150 which carried the lens driving gear 100 of drawing 1 . It fixes and this optical pickup 150 becomes the optical pedestal 60 by which it rose inside with the semiconductor laser component equipment 61 and the collimator lens 62 incorporating semiconductor laser and a photo detector, and the mirror 63 was installed in it so that the chief ray of the laser beam which had the optical path changed by the starting mirror 63 may be mostly in agreement with the optical axis of an objective lens 10, while that longitudinal direction and the beam shaft of a laser beam injected from semiconductor laser component equipment 61 are

parallel about the above-mentioned lens driving gear 100.
[0031] The drive coil unit 50 which consists of a focal coil 51 and a tracking coil 52 as mentioned above is carried in the lens attachment component 20. On the other hand, the yoke 53 of a U character mold is being fixed to the location corresponding to the drive coil unit 50 concerned of the optical pedestal 60, and inside the yoke 53 concerned, the magnets 54 and 54 of a couple are arranged so that a different magnetic pole may counter, and by forming a magnetic circuit between said drive coil units 50, it is constituted so that the electromagnetic driving force of the direction of a focus and the direction of tracking may be generated.
[0032] (Actuation of an optical pickup 150) Actuation of an optical pickup 150 is explained below. After the laser beam by which outgoing radiation was carried out from the semiconductor laser component in the semiconductor laser equipment 61 on the optical pedestal 60 is made parallel light by the collimator lens 62, an optical-path change is made by the starting mirror 63 in the direction parallel to the optical axis of an objective lens 10, and it is condensed on the information recording surface 81 of an optical recording medium 80 through the objective lens 10 concerned.
[0033] The same optical path as the time of incidence is reversed, light is received by the photo detector of the semiconductor laser component equipment 61 interior, and the return light reflected by the information recording surface 81 of an optical recording medium 80 is detected as a servo signal including a focal error signal and a tracking-error signal, and an information record signal, and is sent to a non-illustrated control circuit. In addition, since the detection approach of each of these signals itself is a well-known technique, it does not explain in full detail here.
[0034] A non-illustrated control circuit controls the actuation current energized in the focal coil 51 based on a focal error signal. While driving in the direction of a focus so that the focus of an objective lens 10 may be located on the information recording surface 81 according to a magnetic operation of the focal coil 51 and magnets 54 and 54 concerned Based on a tracking-error signal, the actuation current energized in the tracking coil 52 is controlled, and according to a magnetic operation of the tracking coil 52 and magnets 54 and 54 concerned, it drives in the direction of tracking so that the optical axis of an objective lens 10 may follow in footsteps of the information record train of the information recording surface 81. Since resonance is effectively controlled in the direction of a focus, and the direction of a racking as mentioned above by the damper member installed by each flections 311-341 and this part of the elastic support members 31-34 even if resonance tends to arise in the lens attachment component 20 by these high-speed actuation, the information on an optical recording medium 80 can be read with a sufficient precision.
[0035] (The manufacture approach of the lens driving gear 100) Next, the manufacture approach of the above-mentioned lens driving gear 100 is explained, referring to drawing 4 . First, since the up-and-down elastic support members 31-34 are constituted, prepare the conductive plate members 301a and 301b of two sheets which consist of the metal plate which has moderate elasticity, for example, phosphor bronze, titanium copper, beryllium copper, etc., the part which is equivalent to flections 311-341 with press working of sheet metal according this to bending metal mold is made crooked in down and above, respectively, and Steps 3011a and 3011b are formed (process (a)).
[0036] Next, each plate members 301a and 301b are pierced by the die press, an unnecessary part is removed, and the leadframe members 302a and 302b from which the up-and-down elastic support members 31-34 will be in the condition of having been tied to the surrounding frame are formed (process (b)). The metal mold for these punching is the elastic support members 31, 32, and 33 on either side and the configuration in which 34 is crooked toward the inside in the part of each step 3011a and 3011b, and, thereby, the flections 311-341 by which predetermined include-angle crookedness was carried out are formed in the both sides of the direction of a focus, and the direction of tracking at each.
[0037] Then, lower leadframe member 302b is put on the Shimokane draw spike which is not illustrated, is seen from the direction where an elastic support member is prolonged next, and closes horizontal metal mold from a longitudinal direction. At this time, some of Shimokane molds and horizontal metal mold touch in the form which pinches a part of lower leadframe member 302a from the upper and lower sides. Then, upper leadframe member 302a is placed on horizontal metal mold, and un-illustrating top metal mold closes from an upside. In here, some of top metal mold and horizontal metal mold pinch a part of upside leadframe member 302b similarly.
[0038] Thus, in the condition of having been thoroughly fixed to metal mold, insert molding by resin is performed, and as the up-and-down leadframe members 302a and 302b embed the edge of the elastic support members 31-34, they form the lens attachment component 20 and the fixed side member 40 in one (process (c)). Next, a frame part with the unnecessary leadframe members 302a and 302b of the upper and lower sides which remain on the outside of the lens attachment component 20 and the fixed side member 40 is excised, and each of the elastic support members 31-34 is separated electrically (process (d)).
[0039] And while carrying an objective lens 10 in the lens attachment component 20, the drive coil unit 50 is mounted and electric connection with the electrode terminal inside [lens attachment component 20] the elastic support members 31-34 is made with wiring techniques, such as wirebonding and soldering. This becomes possible to perform the actuation current supply source to the drive coil unit 50 through the elastic support members 31-34.
[0040] The last is filled up with the damper member for the resonance control to the crevices 41-44 on the fixed side member 40. Thus, an optical pickup 150 is manufactured by fixing in the predetermined location of the optical pedestal 60 where the manufactured lens driving gear 100 was already carried in semiconductor laser equipment 61, the collimator lens 62, and the starting mirror 63.
[0041] In addition, it may be made to perform clearance of the garbage of the leadframe members 302a and 302b in the above-mentioned process (d) after loading of an objective lens 10 etc. Drawing of following drawing 5 (a) - (c) and drawing 6 (a) - (c) is a schematic diagram showing the situation of the insert molding in the above-mentioned process (c), and drawing of longitudinal section when seeing from arrow-head B in drawing 4 shows it so that it may be easy to understand the combination condition of metal mold. In addition, except for drawing 6 (c), the sectional view [in / for the sectional view in the location of the C-C / in / for convenience / metal mold / drawing of the process (c) of drawing 4 / line of explanation / D-D line] is shown about the leadframe members 302a and 302b. Moreover, the cross-section configuration of the fixed side member 40 is also simplified and shown.
[0042] As shown in drawing 5 (a), the metal mold for insert molding is quadrisection metal mold, and consists of the top metal

mold 901, a Shimokane mold 902, and two horizontal metal mold 903 and 904, and the injected hole 905 of resin is formed in the top metal mold 901. First, lower leadframe member 302b is laid on the Shimokane mold 902 (drawing 5 (b)), the horizontal metal mold 903 and 904 is laid on it, and upper leadframe member 302a is laid further (drawing 5 (c)). Then, the top metal mold 901 is put from the upper part, and where it turned this to the Shimokane mold 902 and it is pressed, the resin of a melting condition is poured in with high voltage from an injected hole 905 (drawing 6 (a)). After resin solidifies, while removing the top metal mold 901 up, the horizontal metal mold 903 and 904 is sampled horizontally, the resin which remained in the injected hole 905 is removed (drawing 6 (b)), and the configuration shown at the process (c) of drawing 4 is acquired (drawing 6 (c)).

[0043] Thus, it is because that insertion formation can be easily carried out with the metal mold of quadrisection has the parallel principal plane of each part containing the flections 311-341 of the elastic support members 31-34 concerned to the direction where the horizontal metal mold is closed, the sense has gathered, there being four elastic support members 31-34, and having the flection 311,312,331,341 to a 2-way, respectively, so horizontal metal mold can be managed with one kind of right and left at a time.

[0044] Since the lens attachment component 20 and the fixed side member 40 are really fabricated by resin according to the manufacture approach of the lens driving gear 100 in the gestalt of this operation, fixing the leadframe members 302a and 302b with metal mold as explained above The process which connects between the lens attachment component 20 and the fixed side members 40 separately by the elastic support members 31-34 becomes unnecessary. Moreover, while controlling dispersion in the property of each [removing the garbage of a leadframe member after shaping] and realizing the stable property, it becomes possible to raise productivity.

[0045] In the gestalt of implementation of the <gestalt of the 2nd operation> above 1st, since the fixed side member 40 of the lens driving gear 100 is carried in the optical pedestal 60 in which semiconductor laser equipment 61 and the starting mirror 63 were carried and an optical pickup is constituted, even if it drives an objective lens 10, semiconductor laser equipment 61 will not move but, thereby, both physical relationship will change delicately. In order to read recording information with a still more sufficient precision, it cannot be overemphasized that it is desirable not to change while the physical relationship of an objective lens and each optical element has been in the optimal condition.

[0046] Therefore, he contains the optical element containing semiconductor laser in the case holding an objective lens, and is trying to always keep constant the optical physical relationship of the optical element of an objective lens and others by making it move the whole case concerned in the gestalt of operation of **** 2.

(Configuration of an optical pickup) Drawing 7 is the perspective view showing the configuration of the optical pickup 200 concerning the gestalt of operation of **** 2.

[0047] As shown in this drawing, an optical pickup 200 It connects with the case 220 which is the movable side member in which the carrier light emitting device substrate (this drawing un-illustrating) in which the objective lens 210, the semiconductor laser component, and the photo detector were unified and carried is stored, the fixed side member 240 placed in a fixed position on a non-illustrated optical pedestal, a case 220, and the fixed side member 240, respectively. It has 16 conductive elastic support members 230 which support a case 220 movable to the fixed side member 240.

[0048] The drive coil unit 250 which becomes a case 220 from the focal coil 251 which makes a case 220 drive in the direction of a focus of an optical recording medium, and the tracking coil 252 which makes a case 220 drive in the direction of tracking of an optical recording medium is carried. On the other hand, inside the yoke 253 fixed on the optical substrate 245 (refer to drawing 8), the magnet 254,254 of a couple is arranged so that a different magnetic pole may counter, and by forming a magnetic circuit between said drive coil units 250, it is constituted so that the electromagnetic driving force of the direction of a focus and the direction of tracking may be generated.

[0049] The location in the direction of X of the end point 232 of 16 elastic support members 230 and a case 220 (namely, longitudinal direction of the elastic support member 230) Adjustment by the appearance configuration, loading of a spindle, etc. is in drawing so that it may suppose that it is almost the same as the location of the direction of X of the power point which the electromagnetic driving force to the drive coil unit 250 requires and the location in the direction of X of the center of gravity of a case 220 may also be mostly in agreement with the location of the direction of X of said end point 232.

[0050] 16 elastic support members 230 are divided into 4 sets of four directions. Like the gestalt of the 1st operation, respectively By forming the flection 231 crooked in the 2-way of Z and Y in the part corresponding to the crevices 241-244 established in the fixed side member 240, and filling up these crevices 241-244 with a non-illustrated damper member The resonance in the large frequency region ranging from the low frequency field to a RF field can be effectively prevented now. Only a part with many numbers of the elastic support member 230 can enlarge resonance depressor effect rather than the gestalt of the 1st operation.

[0051] Moreover, the edge which it got down from each elastic support member 230 electric independently, respectively, and the edge by the side of a case 220 was electrically connected with the semiconductor laser component carried in the carrier light emitting device substrate of the case 220 interior, the photo detector, and the drive coil unit 250, and projected from the end face of the fixed side member 240 is connected to a non-illustrated control circuit. The need that this connects and takes about direct lead wire to the semiconductor laser carried in the case 220, a photo detector, and the drive coil unit 250 is lost, and it becomes possible to drive the lens attachment component 20 smoothly.

[0052] Next, the configuration inside a case 220 is explained. Drawing 8 is drawing of longitudinal section in the direction of X of drawing 7 which shows typically the internal configuration of the case 220 in the gestalt of this operation. As shown in this drawing, the carrier light emitting device substrate 71 in which the semiconductor laser component and the photo detector were carried in one is formed in a case 220, and the 1st reflector 72 in which the below-mentioned reflective mold hologram field was established with the means of etching or resin shaping is established on the optical path of the laser beam injected from the semiconductor laser component 74 (refer to drawing 10).

[0053] It is prepared so that the laser beam injected from the semiconductor laser component 74 may become parallel [the 2nd reflector 73] to the 1st reflector 72 on the optical path of the reflected light in the 1st reflector 72, and the physical relationship of these optics, the focal distance of an objective lens 210, etc. are set up so that the light reflected in the 2nd reflector 73 may be condensed on the information recording surface 81 of an optical recording medium 80 through an

objective lens 210.
[0054] In addition, with the gestalt of this operation, he is trying to prevent that seal upside opening of a case 220 by the objective lens one apparatus hologram optical element 211 which fabricated the 1st reflector 72 and objective lens 210 to one, and dust etc. trespasses upon the interior, and, thereby, the dependability of optical system can be secured. Moreover, the effectiveness of the cutback of components mark and a cutback of adjustment manday is also acquired by fabricating the 1st reflector 72 and objective lens 210 to one in this way.
[0055] Moreover, in the gestalt of this operation, although the elastic support member 230 consists of 16 conductive members, no elastic support members 230 need to be used for current potential supply and signal wiring that what is necessary is just to determine the number of the elastic support member 230 in consideration of the required number of signal wiring. However, when the balance of the vertical direction and a longitudinal direction is taken into consideration, it is desirable to consider a number as arrangement symmetrical to the upper and lower sides or right and left as even number or a multiple of 4.
[0056] (Actuation of an optical pickup 200) Next, actuation of the optical pickup 200 constituted as mentioned above is explained. It reflects in the 1st reflector 72 which has a reflection hologram field, and when being continuously reflected further by the 1st reflector 72 and the 2nd reflector 73 arranged at parallel, the chief ray carries out incidence of the laser beam injected from the semiconductor laser component carried in the case 220 to the objective lens 210 concerned in the condition of having been mostly in agreement with the optical axis of an objective lens 210. The laser beam which penetrated the objective lens 210 is condensed on the information recording surface 81 on an optical recording medium 80.
[0057] The optical path which came is reversed, an objective lens 210 is passed, it is reflected by the 2nd reflector 73, and reflection diffraction of the return light of the laser beam reflected by the information recording surface 81 concerned is carried out by the reflective mold hologram field formed on the 1st reflector 72. The return light concerned branches to two or more flux of lights by diffraction in a reflective mold hologram field, it condenses to up to two or more photo detectors carried in the carrier light emitting device substrate 71, respectively, and, thereby, a focal error detecting signal, a tracking-error detecting signal, and an information record signal are outputted.
[0058] Drawing 9 is drawing showing the configuration of the reflective mold hologram field 76 currently formed on the 1st reflector 72. As shown in this drawing, this reflective mold hologram field 76 includes two hologram fields 761 and 762 divided by the parting line 763 almost parallel to the information record train on an optical recording medium 80, and reflection diffraction of the return light from an optical recording medium 80 is carried out in each field. The reflective mold hologram field 76 makes the pitches of a diffraction grating differ so that whenever [angle-of-diffraction] may differ in the hologram fields 761 and 762 while being the curvilinear pattern which gave the wave-front conversion function (the lens effectiveness) so that the focal distances of the +primary diffracted light from the same field and the -primary diffracted light might differ among the diffracted lights diffracted by reflex time, and took into consideration the incident angle dependency of reflex time.

[0059] Drawing 10 is the perspective view showing signs that the above-mentioned diffracted light condenses on the carrier light emitting device substrate 71. it is shown in this drawing -- as -- the carrier light emitting device substrate 71 -- mostly, the semiconductor laser component 74 is carried in a center section, and the trichotomy photo detectors 75a, 75b, 75c, and 75d for tracking-error [focal error detection-cum-] detection are formed in it between the foci of the primary [**] diffracted light in each of the hologram fields 761 and 762.
[0060] It is a configuration using the push pull method for carrying out differential detection and performing the flux of light reflected in tracking-error detection by each of the hologram fields 761 and 762 in the spot size detection method for detecting change of the diameter of a spot of the primary [**] diffracted light in focal error detection, and carrying it out to it to the information record train and perpendicular direction on an optical recording medium 80. A control circuit controls the current supplied to the focal coil 251 on a case 220 according to the amount of detection of the focal error detected by each photo detector on the carrier light emitting device substrate 71. According to the supplied current, electromagnetic driving force arises in the focal coil 251 in a magnetic circuit, movable [of the case 220] is carried out in the direction of an optical axis, and imitation actuation (focus servo) to the signal side on an optical recording medium 80 is performed.
[0061] The current supplied to the tracking coil 252 on a case 220 according to the amount of detection of the tracking error detected from the light-receiving result of each photo detector is controlled after the above-mentioned focus servo. According to the supplied current, magnetic driving force arises in the tracking coil 252 in a magnetic circuit, and it carries out movable [of the case 220] in the direction which crosses the information record train on an optical recording medium 80. The above-mentioned actuation performs imitation actuation (tracking servo) to the information record train of an optical recording medium 80. An information record signal is detected after a tracking servo.
[0062] In addition, as a semiconductor laser component 74, the semiconductor laser component of a single wavelength range may be used, and at least two or more semiconductor laser components from which wavelength differs may be used. Furthermore, the monolithic multi-wavelength semiconductor laser component which has a point corresponding to at least two or more different wavelength ranges emitting light in a single semiconductor laser component may be used. Since playback wavelength is chosen for every optical recording medium, it becomes possible by making it many wavelength-ization in this way to correspond to record playback of many kinds of optical recording media.
[0063] (The manufacture approach of an optical pickup 200) Next, it explains, referring to drawing 11 about the manufacture approach of the optical pickup 200 concerning the gestalt of the 2nd operation. Also in the production process of an optical pickup 200, it performs almost like the gestalt of the 1st operation including the process which really fabricates a case 220, the fixed side member 240, and the elastic support member 230 by insert molding.
[0064] First, since the up-and-down elastic support member 230 is constituted, prepare the conductive plate members 401a and 401b of two sheets which consist of phosphor bronze, titanium copper, beryllium copper, etc., the part which is equivalent to a flection 231 with press working of sheet metal according this to bending metal mold is made crooked in down and above, respectively, and Steps 4011a and 4011b are formed (process (a)).
[0065] And each plate members 401a and 401b are pierced by the die press, an inside predetermined part is removed, and the leadframe members 402a and 402b from which the up-and-down elastic support member 230 will be in the condition of

having been tied to the surrounding frame are formed (process (b)). This metal mold for punching has the part where the elastic support member 230 on either side is mutually crooked towards the inside in each step 4011a and 4011b, and, thereby, a flection 231 is formed.
[0066] Predetermined spacing in the condition of having set the leadframe members 402a and 402b, and having made them countering Then, top metal mold, It pinches and fixes with horizontal metal mold and the Shimokane mold (drawing of metal mold is omitted in this drawing. process (c):). Resin is poured in into the metal mold concerned and insert molding is performed, and in a case 220 and the fixed side member 240, as the edge of the elastic support member 230 is embedded, it really forms (process (d)).
[0067] After really fabricating, the carrier light emitting device substrate 71 and the drive coil unit 250 grade after inserting the objective lens one apparatus hologram optical element 211 are mounted in a case 220, and electric connection with the electrode terminal inside [case 220] the elastic support member 230 is made with wiring techniques, such as wirebonding and soldering. Next, the frame part of the leadframe members 402a and 402b of the upper and lower sides which remain on the outside of a case 220 and the fixed side member 240 is excised, and each of the elastic support member 230 is separated electrically (process (e)).
[0068] This becomes possible to perform the actuation current supply source to the actuation current supply source, the driver voltage supply to a photo detector 75, detecting-signal output, and the drive coil unit 250 to the semiconductor laser component 74 through the elastic support member 230. The crevices 241-244 on the fixed side member 240 are filled up with the viscoelasticity member which is not illustrated for resonance control at the last, and the fixed side member 240 is fixed on the optical pedestal 245 to which the magnet 254 was fixed through the yoke 253.
[0069] In addition, in advance of mounting of optical system etc., it may be made to perform clearance of the garbage in the above-mentioned process (e), and it may be made to carry out after fixing the fixed side member 240 on the optical pedestal 245. Since the case 220 and the fixed side member 240 are really fabricated in the manufacture approach of the optical pickup of the gestalt this operation by resin, fixing the leadframe members 402a and 402b with metal mold as explained above, the process which connects between a case 220 and the fixed side members 240 according to an individual by the elastic support member 230 becomes unnecessary.
[0070] Moreover, since he is trying to remove the garbage of a leadframe member after shaping, it connects with a case 220 and the fixed side member 240 under an equal condition, and dispersion in the mounting condition between them is controlled, and while each elastic support member 230 realizes the support condition by which moving-part material was stabilized, it becomes possible to raise productivity of it. As mentioned above, according to the optical pickup and its manufacture approach of this invention, resonance depressor effect can be excellent, and the optical pickup of one apparatus by which the optical property was stabilized can be manufactured, and improvement in productivity can also be aimed at.
[0071] Although the optical pickup concerning this invention and its manufacture approach have been explained based on the gestalt of operation beyond the <modification>, the content of this invention is not necessarily limited to the example explained to the detail above, for example, can also consider the following modifications.
** In the gestalt of each above-mentioned implementation, although considered as the configuration of the actuator equipment of the so-called moving coil type (MC mold) which carries a drive coil unit in a moving-part material side, and carries a magnet in an optical pedestal side, it is good also as a configuration of the so-called MUBINGU magnet type (MM mold) which carries a drive coil in an optical pedestal side, and carries a magnet in a case side of actuator equipment.
[0072] ** Although it is more desirable to be the same location of a longitudinal direction and to be formed in the bottom symmetry of the left upper right moreover, if the location of the flection of each elastic support member considers the balance of equal resonance depressor effect or the whole holding power in the gestalt of each above-mentioned implementation, a gap of some is permitted in the range which does not have a problem in the accuracy of reading. Moreover, the above-mentioned flection may also include a configuration which it not only carries out plastic deformation like the gestalt of the above-mentioned implementation, but is incurvated towards a Z direction.
[0073] Like the gestalt of the 2nd operation, when there are many numbers of an elastic support member, the effectiveness of resonance control sufficient by just preparing a flection about some elastic support members can be acquired.
** A damper member is made to intervene between the wall surfaces of a flection and the crevice of a fixed side member like the gestalt of each above-mentioned implementation, and although the effectiveness of resonance control becomes the outstanding thing by making it the configuration with which a flection is held through a damper member in the above-mentioned crevice, even if it does not necessarily make it such a configuration, installing can also acquire the resonance depressor effect of extent so that only the flection concerned may be covered by the damper member.
[0074] ** It is also possible for there to be not necessarily no need of forming the 1st crookedness made towards a Z direction and the 2nd crookedness made towards the direction of Y in the same location of a longitudinal direction like the flection of each above-mentioned elastic support member, and to form in a different location. However, since the range filled up with a damper member in this case spreads, if it carries out from a viewpoint of damper member economization, it will be desirable to form the 1st crookedness and crookedness of the 2nd in the almost same location too.
[0075] ** In the production process (drawing 4 , drawing 11) in the gestalt of each above-mentioned implementation, although the case where insert molding of the one optical pickup was carried out with 1 set of metal mold was explained, it may be made to carry out insert molding of two or more bodies of a lens driving gear by the inside of 1 set of metal mold simultaneously. It explains referring to drawing 12 about the case where insert molding of the body of the lens driving gear 100 applied to the gestalt of the 1st operation as the example is put in order and carried out to a two-piece longitudinal direction.
[0076] First, since 2 sets of up-and-down elastic support members 31-34 are constituted, prepare the conductive plate members 351a and 351b of two sheets which consist of phosphor bronze, titanium copper, beryllium copper, etc., the part which is equivalent to flections 311-341 with press working of sheet metal according this to bending metal mold is made crooked in down and above, respectively, and Steps 3511a and 3511b are formed (process (a)).
[0077] Next, each plate members 351a and 351b are pierced by the die press, an unnecessary part is removed, and the leadframe members 352a and 352b from which the elastic support members 31-34 of 2 sets of upper and lower sides will be

in the condition of having been tied to the surrounding frame are formed (process (b)). Then, lower leadframe member 352b is put on the Shimokane draw spike which is not illustrated, and it arranges a core in the center section while it is seen from the direction where an elastic support member is prolonged next and closes horizontal metal mold from a longitudinal direction. At this time, a part of Shimokane mold, horizontal metal mold, and core touch in the form which pinches a part of lower leadframe member 352b from the upper and lower sides. then, horizontal metal mold and a core — upper leadframe member 352a is put on a top, and un-illustrating top metal mold closes from an upside. In here, a part of upside leadframe member 352b is similarly pinched by a part of top metal mold and horizontal metal mold, and core.

[0078] Thus, in the condition of having been thoroughly fixed to metal mold, insert molding by resin is performed, and as the up-and-down leadframe members 352a and 352b embed the edge of each elastic support member 31-34, they form 2 sets of lens attachment components 20, and the fixed side member 40 in one (process (c)). Then, metal mold is removed, a frame part with the unnecessary leadframe members 352a and 352b of the upper and lower sides which remain on the outside of the lens attachment component 20 and the fixed side member 40 is excised, each of the elastic support members 31-34 is separated electrically, and the body part of two lens driving gears 100 is formed (process (d)).

[0079] Thus, as the number which carries out insert molding simultaneously can be placed, it cannot be overemphasized that mass production becomes possible and it ** to a cost cut. In addition, in drawing 12 , since insert molding of the body of a lens driving gear was put in order and carried out to the longitudinal direction, a core is needed, but when more than one are arranged in a lengthwise direction (direction where an elastic support member is extended), a core also becomes unnecessary, can fabricate two or more bodies of a lens driving gear only with quadrisection metal mold, and ** them to fertilization further.

[0080]

[Effect of the Invention] As explained above, according to the lens driving gear or optical pickup concerning this invention The 1st member holding a lens is held by the 2nd member through two or more elastic support members prolonged in the same direction. Two or more elastic support members concerned Since it constituted while having resulted [from the 2nd member] in the 1st member, respectively so that it might have the 1st flection crooked towards the 1st direction, and the 2nd flection crooked towards the 1st direction and the 2nd direction which intersects perpendicularly mostly The variation rate of the oscillation which it is going to produce in the 1st member can be expanded by the flection concerned, and big resonance depressor effect can be acquired by installing a damper member into this part. And since the 1st and the 2nd flection are crooked towards two directions which intersect perpendicularly, respectively, if both flections can share the oscillating component in all directions, displacement amplification can be carried out and the resonance depressor effect by the damper member is made to act on this, positive resonance depressor effect will be acquired from a low frequency band to resonance in the large range to a high-frequency band.

[0081] Moreover, since the principal plane of each part which is tabular [of ** length], respectively and contains those flections is formed so that it may become in parallel with the specific direction of 1 which intersects perpendicularly with the longitudinal direction of an elastic support member, by considering as the configuration which closes horizontal metal mold along the specific direction concerned of 1, insert molding is attained easily and two or more elastic support members can produce the equipment which does not have dispersion in the engine performance to a large quantity.

[0082] According to the manufacture approach of the lens driving gear concerning this invention, moreover, the production process of the structure which consists of the 1st member for holding a lens, and the 2nd member which holds this 1st member through two or more elastic support members Process plate material and two or more elastic support members which have the 2nd flection crooked towards the 2nd direction which is parallel to the 1st flection crooked towards the 1st direction which intersects perpendicularly with the principal plane of said plate material, and the principal plane of said plate material, and intersects perpendicularly with said longitudinal direction are prepared in the middle of the longitudinal direction. Since the 1st and the 2nd member are formed with injection molding and injection molded as the connection section of said the 1st and 2nd member of said elastic support member which are books is embedded, respectively The process which connects separately between the 1st member which is a movable side member, and the 2nd member which is a fixed side member by the elastic support member becomes unnecessary, and it becomes possible to mass-produce the lens driving gear which has the effectiveness of the above-mentioned resonance control, without producing dispersion.

[0083] And if two or more structures are simultaneously fabricated with 1 set of metal mold, fertilization of an accurate lens driving gear will become easier.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the appearance perspective view of the lens driving gear in the gestalt of operation of the 1st of this invention.
[Drawing 2] (a) and (b) are drawings showing that resonance is controlled effectively in the flection of an elastic support member, respectively.
[Drawing 3] It is drawing of longitudinal section showing the configuration of the optical pickup which carried the lens driving gear of drawing 1 .
[Drawing 4] It is the schematic diagram showing the production process of the lens driving gear of drawing 1 .
[Drawing 5] It is drawing showing the process which carries out insert molding of the body of a lens driving gear.
[Drawing 6] It is drawing showing a continuation of the process of the insert molding of drawing 5 .
[Drawing 7] It is the appearance perspective view of the optical pickup concerning the gestalt of operation of the 2nd of this invention.
[Drawing 8] It is drawing of longitudinal section showing the configuration of the optical pickup concerning the gestalt of implementation of the above 2nd.
[Drawing 9] It is drawing showing the configuration of the reflective mold hologram field of the 1st reflector installed in the optical path of the above-mentioned optical pickup.
[Drawing 10] It is drawing showing signs that the return light from an optical recording medium branches by diffraction, and is condensed by the reflective mold hologram field of the 1st reflector of the above at each photo detector.
[Drawing 11] It is the schematic diagram showing the production process of the optical pickup of drawing 7 .
[Drawing 12] It is drawing showing the process in the case of putting in order and manufacturing two bodies of a lens driving gear of drawing 1 .
[Drawing 13] (a) and (b) are drawings showing the supporting structure of the movable side member for the resonance prevention in the conventional lens driving gear, respectively.
[Description of Notations]
10,210 Objective lens
20 Lens Attachment Component
31-34,230 Elastic support member
40,240 Fixed side member
50,250 Drive coil unit
51,251 Focal coil
52,252 Tracking coil
60,245 Optical pedestal
61 Semiconductor Laser Component Equipment
62 Collimator Lens
63 Starting Mirror
71 Carrier Light Emitting Device Substrate
74 Semiconductor Laser Component
75a-75d Photo detector
76 Reflective Mold Hologram Field
80 Optical Recording Medium
81 Information Recording Surface
100 Lens Driving Gear
150,200 Optical pickup
211 Objective Lens One Apparatus Hologram Optical Element
220 Case
311-341,231 Flection
411 Damper Member

[Translation done.]

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最終頁に続く

(54)【発明の名称】　レンズ駆動装置、当該装置を用いた光ピックアップおよびレンズ駆動装置の製造方法

(57)【要約】
【課題】　対物レンズの高速駆動により生じる共振を効果的に抑制することができるレンズ駆動装置を提供する。
【解決手段】　対物レンズ１０を保持するレンズ保持部材２０は、各部の主面が、Ｙ方向に平行になるように形成された４本の弾性支持部材３１～３４を介して固定側部材４０に可動に保持される。弾性支持部材３１～３４の固定側部材４０側の基端部にはそれぞれ、対物レンズ１０の光軸に平行なＺ方向とこれに直交するＹ方向の２方向に屈曲された屈曲部が設けられており、固定側部材４０の凹部４１～４４にゲル状部材を充填し、当該屈曲部を当該ゲル状部材内に埋め込む。

【特許請求の範囲】
【請求項１】　レンズと、このレンズを所定方向に移動するように駆動する駆動手段とを備えたレンズ駆動装置であって、
レンズを保持する第１の部材と、
前記第１の部材を、同一方向に延びる複数本の弾性支持部材を介して保持する第２の部材とを備え、
前記複数本の弾性支持部材は、前記駆動手段によって駆動力が付与されたときに弾性変形して前記レンズの移動を許容するものであり、それぞれ、第２の部材から第１の部材に至る途中において、第１の方向に向けて屈曲する第１の屈曲部と、第１の方向とほぼ直交する第２の方向に向けて屈曲する第２の屈曲部とを有することを特徴とするレンズ駆動装置。
【請求項２】　前記第１の方向は、前記レンズの光軸と平行な方向であり、前記第２の方向は、前記第１の方向と前記弾性支持部材の延びる方向との双方に直交する方向であることを特徴とする請求項２記載のレンズ駆動装置。
【請求項３】　前記各弾性支持部材の第１と第２の屈曲部は、ダンパー部材に覆われていることを特徴とする請求項１または２に記載のレンズ駆動装置。
【請求項４】　前記ダンパー部材は、ゲル状の素材からなることを特徴とする請求項３記載のレンズ駆動装置。
【請求項５】　各弾性支持部材における前記第１と第２の屈曲部は、当該弾性支持部材の伸びる方向におけるほぼ同一の位置に設けられていることを特徴とする請求項１から４のいずれかに記載のレンズ駆動装置。
【請求項６】　各弾性支持部材における第１の屈曲部と第２の屈曲部は、その相互作用により、当該弾性支持部材の伸びる方向と直交する全ての方向に生じる振動を吸収することを特徴とする請求項１から５のいずれかに記載のレンズ駆動装置。
【請求項７】　前記複数本の弾性支持部材は、それぞれ細長の板状であって、それらの前記屈曲部を含む各部の主面が、当該弾性支持部材の延びる方向と直交する特定の一の方向に平行になるような状態で配設されていることを特徴とする請求項１から６のいずれかに記載のレンズ駆動装置。
【請求項８】　前記特定の一の方向は、前記第２の方向と同じ方向であることを特徴とする請求項７記載のレンズ駆動装置。
【請求項９】　前記第１の部材および第２の部材は、それぞれに連結されるべき前記各弾性支持部材の連結部位を内部に埋め込むようにして、射出成形により成形されてなることを特徴とする請求項１から８のいずれかに記載のレンズ駆動装置。
【請求項１０】　半導体レーザ素子と、半導体レーザ素子から射出されたレーザ光を光記録媒体の情報記録面に集光するレンズを所定方向に駆動するレンズ駆動手段と、光記録媒体からの反射光を受光する受光素子とを備えた光ピックアップであって、
前記レンズ駆動手段として請求項１から９のいずれかに記載のレンズ駆動装置が用いられていることを特徴とする光ピックアップ。
【請求項１１】　前記半導体レーザ素子と受光素子は、請求項１から９のいずれかにおける第１の部材に、レンズに対して所定の位置関係を維持した状態で保持されていることを特徴とする請求項１０に記載の光ピックアップ。
【請求項１２】　レンズを保持するための第１の部材とこの第１の部材を複数本の弾性支持部材を介して保持する第２の部材とからなる構造体を有し、駆動ユニットにより第１の部材を第２の部材に対して所定方向に変位させてレンズを駆動するレンズ駆動装置の製造方法であって、
前記構造体を製造する構造体製造工程と、
当該構造体の第１の部材にレンズを取り付けるレンズ取付工程と、
前記構造体に駆動ユニットを取り付ける駆動ユニット取付工程とを含み、
前記構造体製造工程は、
平板材を加工し、その長手方向途中に、前記平板材の主面と直交する第１の方向に向けて屈曲する第１の屈曲部と、前記平板材の主面と平行であって前記長手方向に直交する第２の方向に向けて屈曲する第２の屈曲部とを有する弾性支持部材を、複数本準備する弾性支持部材準備工程と、
前記複数本の弾性支持部材の、前記第１と第２の部材との連結部をそれぞれ埋め込むようにして、第１と第２の部材を射出成形により形成する射出成形工程とを含むことを特徴とするレンズ駆動装置の製造方法。
【請求項１３】　前記弾性支持部材準備工程は、
プレス加工により、平板材に前記第１の屈曲部に相当する部分に段部を形成する第１の工程と、
この段部が形成された平板材を金型プレス加工もしくはエッチング加工によりさらに第２の屈曲部を有する形状に形成する第２の工程とを含むことを特徴とする請求項１２記載のレンズ駆動装置の製造方法。
【請求項１４】　前記弾性支持部材準備工程は、複数本の弾性支持部材を、それらが所定の間隔でほぼ平行に配列され、その両端部においてフレームに連結された状態で準備すると共に、
前記射出成形工程の後に前記フレームを切除する切除工程を含むこと特徴とする請求項１２または１３記載のレンズ駆動装置の製造方法。
【請求項１５】　対物レンズを保持するための第１の部材とこの第１の部材を複数本の弾性支持部材を介して保持する第２の部材とからなる構造体を有し、駆動ユニットにより第１の部材を第２の部材に対して所定方向に変

位させて対物レンズを駆動するレンズ駆動装置の製造方法であって、
前記構造体を複数個製造する構造体製造工程と、
前記各構造体の第１の部材に対物レンズを取り付けるレンズ取付工程と、
前記各構造体に駆動ユニットを取り付ける駆動ユニット取付工程とを含み、
前記構造体製造工程は、
平板材を加工し、その長手方向途中に、前記平板材の主面と直交する第１の方向に向けて屈曲する第１の屈曲部と、前記平板材の主面と平行であって前記長手方向に直交する第２の方向に向けて屈曲する第２の屈曲部とを有する複数本の弾性支持部材を複数組並べて形成する弾性支持部材準備工程と、
前記複数組の弾性支持部材の、前記第１と第２の部材との連結部をそれぞれ埋め込むようにして各組に対応する第１と第２の部材を一組の金型によって同時に射出成形する射出成形工程とを含むことを特徴とするレンズ駆動装置の製造方法。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、光ディスクなどの光記録媒体から情報を読み取って再生する光学式記録再生装置などに使用される光ピックアップ、その主要部となるレンズ駆動装置および当該レンズ駆動装置の製造方法に関するものである。

【０００２】

【従来の技術】ＣＤ（コンパクトディスク）やＤＶＤ（デジタルヴァーサタイルディスク）の光ディスクなどの光記録媒体の記録情報の記録／再生を行う光学式記録再生装置における光ピックアップに使用されるレンズ駆動装置においては、光記録媒体上の情報記録面に対して焦点を合わせるフォーカスと、情報記録面上の情報記録列（トラック）に対して焦点を追随させるトラッキングを行うように構成されている。

【０００３】例えば、ＣＤの光学式記録再生装置では、当該ＣＤが高速で回転するため（１分間に２００回～５００回。）、上記フォーカスとトラッキングのための対物レンズの駆動が短い間隔で頻繁に行われ、その駆動動作に起因して、様々な周波数域において装置固有の共振周波数が生じ、これが光記録媒体からの情報取得に悪影響を与えることになる。

【０００４】そこで、レンズ駆動装置には、低周波数帯域から高周波数帯域において対物レンズの共振を抑制するための構造が必要となる。このような共振抑制を図った従来例として特開平７－１０５５５１号公報に開示されているレンズ駆動装置を挙げることができる（第１の従来技術）。図１３（ａ）に当該第１の従来技術に係るレンズ駆動装置５００の概要を示す。なお、説明の便宜上、固定側部材５０７のみが縦断面で示されている。

【０００５】同図に示すようにこのレンズ駆動装置５００は、対物レンズ５０１を搭載する可動側部材５０２を、４本の細長い弾性支持部材５０３～５０６（図では、支持部材５０４、５０６は、それぞれその手前の支持部材５０３、５０５に重なって見えない。）を介して、固定側部材５０７に片持ち梁状態で保持されている。固定側部材５０７の内部には、各弾性支持部材５０３～５０６の連結基端部を埋めるようにしてダンパー部材が充填される。弾性支持部材５０３～５０６は、当該充填個所においてそれぞれ上方に若干湾曲されており、これにより弾性支持部材の、特に高周波数帯域における小刻みな振動に対してダンパー部材による振動抑制効果を増大させるとしている。

【０００６】また、特開平９－７２０３号公報に開示されているレンズ駆動装置がある（第２の従来技術）。図１３（ｂ）は、この第２の従来技術に係るレンズ駆動装置６００の構成を示す外観斜視図である。同図に示すようにこのレンズ駆動装置６００は、対物レンズ６０１を搭載する可動側部材６０２を、４本の細長い弾性支持部材６０３～６０６を介して、固定側部材６０７に片持ち梁状態で保持されている。弾性支持部材６０３は、予め金属の平板を金型プレスなどにより、手前側端部にＵ字上の折り返し部６０３ａを形成するように加工されており、他の弾性支持部材も６０４～６０６も同形状に加工されている。

【０００７】各上下の弾性支持部材６０３、６０４および６０５，６０６は、それぞれ平行ではなく、図のＡ方向から見たときに各横断面が互いにハの字状に向かい合うように、ぞれぞれ長手方向に直交する方向に傾斜させた状態で可動側部材と固定側部材に連結されている。このように主面をハの字状に傾けることにより、フォーカス方向とトラッキング方向における弾性支持部材の振動による変位量を大きくし、各弾性支持部材の折り返し部にダンパー部材（不図示）を添着することにより共振抑制効果を大きくすることができるとしている。

【０００８】

【発明が解決しようとする課題】しかしながら、上記第１の従来技術におけるレンズ駆動装置５００によれば、弾性支持部材５０３～５０６の長手方向や上下方向（フォーカス方向）の共振を有効に抑えることができたとしても、なお、それらに直交する水平方向（トラッキング方向）における振動を有効に抑えることができない。

【０００９】また、弾性支持部材５０３～５０６を撓ませた状態でそれぞれの端部が、可動側部材５０２及び固定側部材５０７に個別に固着されるが、その際に４本の弾性支持部材５０３～５０６を均一に撓ませることが難しい。それらの湾曲量が均一でなければ、可動側部材５０２が固定側部材５０７に対してねじれた状態（チルト状態）で保持されることもになり、しかも部品ごとにその程度にばらつきが生じるため、正確な光情報の取得の

ため決して好ましくはない。これを避けようとすれば、湾曲量を綿密に調整をしながら１本１本の弾性支持部材を取り付ける必要があり、量産性が極度に低下する。

【００１０】このような不都合を解消するため、複数の弾性支持部材の端部をそれぞれ可動側部材５０２、固定側部材５０７に埋め込むようにしてインサート成形することにより、各弾性支持部材の湾曲量をほぼ均一にすることも考えられるが、それでもトラッキング方向における振動を有効に抑制できないことには変わりはない。また、第２の従来例においては、弾性支持部材に共振抑制を目的とするU字状の折り返しパターンを設けると共に上下一対の弾性支持部材の横断面がハの字状になる位置関係で可動側部材及び固定側部材に実装するため、確かにフォーカス方向のみならずトラッキング方向における振動を抑制することも可能なように思われる。しかし、この従来例においても弾性支持部材を個別に装着する場合には、工程数が増えると共に組立て時の弾性支持部材の変形等により特性のばらつきが発生するという問題が生じる。

【００１１】このような取付時におけるばらつきを解消するため、各弾性支持部材を可動側部材及び固定側部材と一体としてインサート成形するような場合ことも考えられるが、上述のように弾性支持部材のインサート成形される面が相互に平行ではないため、単純な上下横構成の金型ではインサート成形は実現できず、さらに多くの分割金型を要し、工程が大変複雑になるといった問題が新たに生ずる。

【００１２】本発明は、上記問題に鑑みなされたものであって、対物レンズを高速駆動により生じる低周波数帯域から高周波数帯域に及ぶ共振を効果的に抑制すると共に、量産性に優れたレンズ駆動装置、その製造方法および当該レンズ駆動装置を用いた光ピックアップを提供することを目的とする。

【００１３】

【課題を解決するための手段】上記課題を解決するために、本発明に係るレンズ駆動装置は、レンズと、このレンズを所定方向に移動するように駆動する駆動手段とを備えたレンズ駆動装置であって、レンズを保持するレンズ保持部材と、前記レンズ保持部材を、同一方向に延びる複数本の弾性支持部材を介して保持する基台とを備え、前記複数本の弾性支持部材は、前記駆動手段によって駆動力が付与されたときに弾性変形して前記レンズの移動を許容するものであり、それぞれ、基台からレンズ保持部材に至る途中において、第１の方向に向けて屈曲する第１の屈曲部と、第１の方向とほぼ直交する第２の方向に向けて屈曲する第２の屈曲部とを有することを特徴としている。このように弾性支持部材の長手方向途中に互いに直交する方向に向けて屈曲する第１の屈曲部と第２の屈曲部を設けているので、この部分にダンパー部材を設ければ、全ての方向における共振を効果的に抑制できる。

【００１４】また、本発明に係るレンズ駆動装置は、前記第１の方向は、前記レンズの光軸と平行な方向であり、前記第２の方向は、前記第１の方向と前記弾性支持部材の延びる方向との双方に直交する方向としているので、光ピックアップのレンズ駆動装置として使用された場合に、そのフォーカス方向とトラッキング方向における不要な振動を有効に抑制できる。

【００１５】さらに、前記各弾性支持部材の第１と第２の屈曲部を、ダンパー部材に覆うことにより有効に共振の抑制効果を得る。ここで、前記ダンパー部材は、ゲル状の素材とするのが望ましい。ゲル状の素材は、全方向にほぼ均一な粘弾性を有し、ダンパー部材に適している。また、各弾性支持部材における前記第１と第２の屈曲部を、当該弾性支持部材の伸びる方向におけるほぼ同一の位置に設けるようにすれば、それらを覆うダンパー部材の量を少なくできる。

【００１６】また、本発明に係るレンズ駆動装置は、前記複数本の弾性支持部材は、それぞれ細長の板状であって、それらの前記屈曲部を含む各部の主面が、当該弾性支持部材の延びる方向と直交する特定の一の方向に平行になるような状態で配設されていることを特徴とする。これにより弾性支持部材を、レンズ保持部材と基台と一体にインサート成形する場合において、当該特定の一の方向から横金型を閉じるようにでき、インサート成形が極めて容易になる。

【００１７】そして、前記レンズ保持部材および基台は、それぞれに連結されるべき前記複数本の弾性支持部材の一部を内部に埋め込むようにして、射出成形により成形されてなる。このようにインサート成形により一体に成形することにより、弾性支持部材を個別に基台やレンズ保持部材に取り付ける手間が不要となり、また、均一な条件下で同時に取り付けられるので、部品ごとのばらつきがなくなる。

【００１８】また、本発明に係る光ピックアップは、上記レンズ駆動装置を用いているので、それらと同等の効果を享受し、レンズの共振が抑制され、光記録媒体の情報の確実な読取／書込が可能となる。ここで、光ピックアップにおける半導体レーザ素子などの部品を上記レンズ保持部材に、レンズに対して所定の位置関係を維持した状態で保持するようにすれば、光学的な精度が安定した光ピックアップを得ることができる。

【００１９】また、本発明に係るレンズ駆動装置の製造方法は、レンズを保持するための第１の部材とこの第１の部材を複数本の弾性支持部材を介して保持する第２の部材とからなる構造体を有し、駆動ユニットにより第１の部材を第２の部材に対して所定方向に変位させてレンズを駆動するレンズ駆動装置の製造方法であって、前記構造体を製造する構造体製造工程と、当該構造体の第１の部材にレンズを取り付けるレンズ取付工程と、前記構

造体に駆動ユニットを取り付ける駆動ユニット取付工程とを含み、前記構造体製造工程は、平板材を加工し、その長手方向途中に、前記平板材の主面と直交する第１の方向に向けて屈曲する第１の屈曲部と、前記平板材の主面と平行であって前記長手方向に直交する第２の方向に向けて屈曲する第２の屈曲部とを有する弾性支持部材を、複数本準備する弾性支持部材準備工程と、前記複数本の弾性支持部材の、前記第１と第２の部材との連結部をそれぞれ埋め込むようにして、第１と第２の部材を射出成形により形成する射出成形工程とを含み、前記弾性支持部材準備工程は、プレス加工により、平板材に前記第１の屈曲部に相当する部分に段部を形成する第１の工程と、この段部が形成された平板材を金型プレス加工もしくはエッチング加工によりさらに第２の屈曲部を有する形状に形成する第２の工程とを含むことを特徴としている。

【００２０】これにより部品ごとのばらつきの少ない装置を量産化することができる。ここで、前記弾性支持部材準備工程は、複数本の弾性支持部材を、それらが所定の間隔でほぼ平行に配列され、その両端部においてフレームに連結された状態で準備すると共に、前記射出成形工程の後に前記フレームを切除する切除工程を含むようにすれば、射出成形時における弾性支持部材の位置が安定するので、さらに装置のばらつきの防止に寄与する。

【００２１】

【発明の実施の形態】以下、本発明に係る光ピックアップの実施の形態を図面に基づき説明する。

＜第１の実施の形態＞

（光ピックアップの構成）まず、本実施の形態に係る光ピックアップにおけるレンズ駆動装置の構成を説明する。

【００２２】図１は、当該レンズ駆動装置１００の要部の構成を示す斜視図である。同図に示すように対物レンズ１０は、可動側部材であるレンズ保持部材２０に搭載され、レンズ保持部材２０は、導電性を有する４本の弾性支持部材３１～３４からなる弾性支持部３０を介して固定側部材４０に連結支持される。固定側部材４０は、さらに光学基台６０（図３参照）に固定される。

【００２３】レンズ保持部材２０には、対物レンズ１０のほか、対物レンズ１０をその光軸方向（フォーカス方向：Ｚ方向）へと駆動させるフォーカスコイル５１と光記録媒体の情報記録列に対して追随を行う方向（トラッキング方向：Ｙ方向）へと駆動させるトラッキングコイル５２とからなる駆動コイルユニット５０が搭載される。

【００２４】弾性支持部材３１～３４は、導電性材料で形成されると共に、各コイルの接続端子は、レンズ保持部材２０内部で、それぞれ弾性支持部材３１～３４と電気的に接続されており、固定側部材４０の外側に突出した端部３１２～３４２から、駆動電流を供給できるようになっている。このように可動側部材であるレンズ保持部材２０側に駆動コイルユニットを搭載することにより、この部分に磁石を搭載するよりも軽量化されると共に弾性支持部材３１～３４が配線リードを兼ねているため、駆動コイルへ通電するため、駆動コイルに直接リード線を接続して引き回すような必要がなくなり、レンズ保持部材２０を円滑に駆動することが可能となる。

【００２５】弾性支持部材３１～３４の固定側部材４０側の基端部付近には、屈曲部３１１～３４１（図１では、屈曲部３４１は、固定側部材４０に隠れて見えない。）が設けられている。固定側部材４０の、各弾性支持部材３１～３４の屈曲部３１１～３４１に該当する位置には、凹部４１～４４が設けられており、ここにゲル状のダンパー部材が充填され、各の屈曲部３１１～３４１が前記ダンパー部材の中に埋没される構造となっている。

【００２６】４本の屈曲部３１１～３４１は、それぞれ上下左右対称に、直交する２方向（図のＺ方向、Ｙ方向）に向けて屈曲されてなり、これにより当該２方向における共振を確実に抑える構造となっている。図２（ａ）は、図１の固定側部材４０の凹部４１における弾性支持部材３１の屈曲部３１１の状態を上方（－Ｚ方向）から見たときの平面図であり、図２（ｂ）は、同箇所をＹ方向から見たときの側面図である。なお、説明の便宜上、両図においてダンパー部材は、弾性支持部材３１が露出するような面に沿った断面で示している。

【００２７】両図に示すように屈曲部３１１は、Ｙ方向へ向けて所定角度屈曲されつつ、－Ｚ方向に向けても所定角度屈曲されており、その周囲にはゲル状のダンパー部材４１１が充填される。このダンパー部材４１１は、例えば、液状シリコーンと架橋剤の混合物からなるシリコーン多孔性物質から形成されており、全方向においてほぼ均一な粘弾性を有するため、優れた共振抑制機能を有する。

【００２８】上述したように光記録媒体の情報を正確に読取るため、対物レンズ１０をフォーカス方向（Ｚ方向）とトラッキング方向（Ｙ方向）に高速で駆動すると、レンズ保持部材２０に低周波領域から高周波領域における特定の周波数域において共振が発生する。低周波領域における共振の場合は、弾性支持部材３１～３４の長手方向に基本波となって振動する共振モードが発生し、高周波領域における共振では高次の共振モードが発生する。

【００２９】高周波領域における高次の共振モードは、主に弾性支持部材３１の長さ方向に生じるため、図２（ａ）、（ｂ）に示すような屈曲部を設けることにより長さ方向と直交する方向の変位量が大きくなり、凹部４１に充填された粘弾性部材の共振抑制効果により確実な共振抑制効果が得られる。また、低周波領域においても、フォーカス方向のみならずトラッキング方向と２方

向に屈曲させているため、両方向における粘弾性部材中の変位量が増加し、これにより共振抑制効果を増大させることができる。

【００３０】図３は、図１のレンズ駆動装置１００を搭載した光ピックアップ１５０の構成を示す縦断面図である。この光ピックアップ１５０は、内部に半導体レーザと受光素子を組み込んだ半導体レーザ素子装置６１とコリメータレンズ６２と立ち上げミラー６３とが設置された光学基台６０に、上記レンズ駆動装置１００を、その長手方向と半導体レーザ素子装置６１から射出されるレーザ光のビーム軸とが平行になると共に、立ち上げミラー６３により光路を変更されたレーザビームの主光線が対物レンズ１０の光軸とほぼ一致するように固着してなる。

【００３１】レンズ保持部材２０には、上述のようにフォーカスコイル５１とトラッキングコイル５２とからなる駆動コイルユニット５０が搭載される。一方、光学基台６０の当該駆動コイルユニット５０に対応する位置には、Ｕ字型のヨーク５３が固定されており、当該ヨーク５３の内側には、異なる磁極が対向するように一対の磁石５４，５４が配置され、前記駆動コイルユニット５０との間で磁気回路を形成することにより、フォーカス方向及びトラッキング方向の電磁的駆動力を発生するように構成されている。

【００３２】（光ピックアップ１５０の動作）次に光ピックアップ１５０の動作について説明する。光学基台６０上の半導体レーザ装置６１内の半導体レーザ素子から出射されたレーザ光は、コリメータレンズ６２により平行光にされた後、立ち上げミラー６３により対物レンズ１０の光軸と平行な方向に光路変更され、当該対物レンズ１０を介して光記録媒体８０の情報記録面８１上に集光される。

【００３３】光記録媒体８０の情報記録面８１で反射された戻り光は、入射時と同じ光路を逆進して半導体レーザ素子装置６１内部の受光素子により受光され、フォーカス誤差信号とトラッキング誤差信号を含むサーボ信号及び情報記録信号として検出され、不図示の制御回路に送られる。なお、これらの各信号の検出方法自体は公知の技術なので、ここでは詳述しない。

【００３４】不図示の制御回路は、フォーカス誤差信号に基づき、フォーカスコイル５１に通電する駆動電流を制御して、当該フォーカスコイル５１と磁石５４，５４の磁気的作用により情報記録面８１上に対物レンズ１０の焦点が位置するようにフォーカス方向に駆動すると共に、トラッキング誤差信号に基づき、トラッキングコイル５２に通電する駆動電流を制御して当該トラッキングコイル５２と磁石５４，５４の磁気的作用により、情報記録面８１の情報記録列に対物レンズ１０の光軸が追随するようにトラッキング方向に駆動する。これらの高速駆動によりレンズ保持部材２０に共振が生じようとしても上述のように弾性支持部材３１～３４の各屈曲部３１１～３４１とこの個所に添着されたダンパー部材により、フォーカス方向とラッキング方向に共振が効果的に抑制されるため、精度よく光記録媒体８０の情報を読取ることができる。

【００３５】（レンズ駆動装置１００の製造方法）次に、上記レンズ駆動装置１００の製造方法について、図４を参照しながら説明する。まず、上下の弾性支持部材３１～３４を構成するために、適度の弾性を有する金属板、例えば、燐青銅、チタン銅、ベリリウム銅などから成る二枚の導電性の平板部材３０１ａ、３０１ｂを用意し、これを曲げ金型によるプレス加工により屈曲部３１１～３４１に相当する部分をそれぞれ下方向、上方向に屈曲させて段部３０１１ａ、３０１１ｂを形成する（工程（ａ））。

【００３６】次に、各平板部材３０１ａ、３０１ｂを、金型プレスで打ち抜いて不要な部分を除去し、上下の弾性支持部材３１～３４が周囲のフレームにつながれた状態となるリードフレーム部材３０２ａ、３０２ｂを形成する（工程（ｂ））。この打ち抜き用の金型は、左右の弾性支持部材３１、３２と３３、３４がそれぞれの段部３０１１ａ、３０１１ｂの個所において内側に向かって屈曲するような形状になっており、これによりフォーカス方向とトラッキング方向の双方にそれぞれに所定角度屈曲された屈曲部３１１～３４１が形成される。

【００３７】その後、下側のリードフレーム部材３０２ｂは、図示しない下金型上に置かれ、次に弾性支持部材の延びる方向から見て左右方向より横金型を閉じる。このとき、下金型及び横金型の一部は、下側のリードフレーム部材３０２ａの一部を上下より挟持する形で接触している。続いて、横金型上に上側のリードフレーム部材３０２ａが置かれ、不図示の上金型が上側より閉じる。ここにおいても同様に上金型及び横金型の一部は、上側リードフレーム部材３０２ｂの一部を挟持するようになっている。

【００３８】このように上下のリードフレーム部材３０２ａ、３０２ｂが完全に金型に固定された状態で、樹脂によるインサート成形を行い、レンズ保持部材２０及び固定側部材４０を、弾性支持部材３１～３４の端部を埋め込むようにして一体に形成する（工程（ｃ））。次に、レンズ保持部材２０及び固定側部材４０の外側に残留している上下のリードフレーム部材３０２ａ、３０２ｂの不要なフレーム部分を切除し、弾性支持部材３１～３４のそれぞれを電気的に分離する（工程（ｄ））。

【００３９】そして、レンズ保持部材２０に対物レンズ１０を搭載すると共に、駆動コイルユニット５０を実装し、ワイヤボンディング、半田付け等の配線技術により、弾性支持部材３１～３４のレンズ保持部材２０内部の電極端子との電気的な接続を行う。これにより、駆動コイルユニット５０への駆動電流供給を、弾性支持部材

３１～３４を介して行うことが可能となる。
【００４０】最後に、固定側部材４０上の凹部４１～４４に共振抑制のためのダンパー部材を充填する。このように製造されたレンズ駆動装置１００を、既に半導体レーザ装置６１、コリメータレンズ６２、立ち上げミラー６３が搭載された光学基台６０の所定位置に固着することにより光ピックアップ１５０が製造される。
【００４１】なお、上記工程（ｄ）におけるリードフレーム部材３０２ａ、３０２ｂの不要部分の除去は、対物レンズ１０などの搭載後に行うようにしてもよい。次の図５（ａ）～（ｃ）および図６（ａ）～（ｃ）の図は、上記工程（ｃ）におけるインサート成形の様子を示す概略図であって、金型の組み合わせ状態が理解しやすいように図４における矢印Ｂ方向から見たときの縦断面図で示している。なお、図６（ｃ）を除き、説明の便宜上、金型については、図４の工程（ｃ）の図におけるＣ－Ｃ線の位置における断面図を、リードフレーム部材３０２ａ、３０２ｂについては、Ｄ－Ｄ線における断面図を示している。また、固定側部材４０の断面形状も簡略化して示している。
【００４２】図５（ａ）に示すようにインサート成形用の金型は４分割金型であって、上金型９０１、下金型９０２および２つの横金型９０３、９０４とからなり、上金型９０１には、樹脂の注入孔９０５が設けられている。まず、下金型９０２上に下側のリードフレーム部材３０２ｂを載置し（図５（ｂ））、その上に横金型９０３、９０４を載置し、さらに、上側のリードフレーム部材３０２ａを載置する（図５（ｃ））。その後、上金型９０１を上方から被せ、これを下金型９０２に向けて押圧した状態で、注入孔９０５から溶融状態の樹脂を高圧で注入する（図６（ａ））。樹脂が固化した後、上金型９０１を上方に取り除くと共に、横金型９０３、９０４を水平方向に抜き取り、注入孔９０５に残存していた樹脂を除去し（図６（ｂ））、図４の工程（ｃ）で示した形状が得られる（図６（ｃ））。
【００４３】このように４本の弾性支持部材３１～３４があり、それぞれ２方向への屈曲部３１１，３１２，３３１，３４１を有しながら、４分割の金型で容易にインサート形成できるのは、当該弾性支持部材３１～３４の屈曲部３１１～３４１を含む各部の主面が、その横金型が閉じられる方向に対して平行であって向きが揃っているため、横金型が左右１種類ずつで済むからである。
【００４４】以上説明したように、本実施の形態におけるレンズ駆動装置１００の製造方法によれば、リードフレーム部材３０２ａ、３０２ｂを金型で固定しつつ、レンズ保持部材２０及び固定側部材４０を樹脂で一体成形しているので、レンズ保持部材２０と固定側部材４０との間を弾性支持部材３１～３４で個々に接続する工程が不要となり、また、成形後にリードフレーム部材の不要部分を除去することで個々の特性のばらつきを抑制し、安定した特性を実現すると共に生産性を向上させることが可能となる。
【００４５】＜第２の実施の形態＞上記第１の実施の形態においては、レンズ駆動装置１００の固定側部材４０を、半導体レーザ装置６１や立ち上げミラー６３を搭載した光学基台６０に搭載して光ピックアップが構成されるので、対物レンズ１０を駆動しても半導体レーザ装置６１は移動せず、これにより両者の位置関係が微妙に変化してしまう。さらに精度よく記録情報を読み取るためには、対物レンズと各光学素子の位置関係が最適な状態のまま変化しないことが望ましいのは言うまでもない。
【００４６】そのため、本第２の実施の形態においては、半導体レーザを含む光学素子を対物レンズを保持する筐体内に収納し、当該筐体ごと移動させることにより対物レンズとその他の光学素子の光学的位置関係を常に一定に保つようにしている。
（光ピックアップの構成）図７は、本第２の実施の形態に係る光ピックアップ２００の構成を示す斜視図である。
【００４７】同図に示されるように、光ピックアップ２００は、対物レンズ２１０や半導体レーザ素子及び受光素子を一体化して搭載した受発光素子基板（同図には不図示）が格納される可動側部材である筐体２２０、不図示の光学基台上に固定配置される固定側部材２４０、筐体２２０及び固定側部材２４０にそれぞれ連結され、筐体２２０を固定側部材２４０に対して可動に支持する１６本の導電性の弾性支持部材２３０を備えている。
【００４８】筐体２２０には、筐体２２０を光記録媒体のフォーカス方向に駆動させるフォーカスコイル２５１と、筐体２２０を光記録媒体のトラッキング方向に駆動させるトラッキングコイル２５２とからなる駆動コイルユニット２５０が搭載される。一方、光学基板２４５（図８参照）上に固定されたヨーク２５３の内側には、異なる磁極が対向するように一対の磁石２５４，２５４が配置されており、前記駆動コイルユニット２５０との間で磁気回路を形成することにより、フォーカス方向及びトラッキング方向の電磁的駆動力を発生するように構成される。
【００４９】１６本の弾性支持部材２３０と筐体２２０との連結点２３２のＸ方向（すなわち、弾性支持部材２３０の長手方向）における位置は、駆動コイルユニット２５０への電磁的駆動力のかかる力点のＸ方向の位置とほぼ同じとしており、また、筐体２２０の重心のＸ方向における位置も前記連結点２３２のＸ方向の位置とほぼ一致するよう、その外形形状や錘の搭載などによる調整を図っている。
【００５０】１６本の弾性支持部材２３０は、上下左右の４組に分かれ、それぞれ第１の実施の形態と同様、固定側部材２４０に設けられた凹部２４１～２４４に対応する個所においてＺとＹの２方向に屈曲する屈曲部２３

１が形成され、この凹部２４１～２４４に不図示のダンパー部材が充填されることにより、低周波領域から高周波領域にわたる広い周波数域における共振を効果的に防止することができるようになっている。第１の実施の形態よりも、弾性支持部材２３０の本数が多い分だけ共振抑制効果を大きくすることができる。

【００５１】また、各弾性支持部材２３０は、それぞれ電気的に独立しており、筐体２２０側の端部は、筐体２２０内部の受発光素子基板に搭載された半導体レーザ素子と受光素子、及び駆動コイルユニット２５０と電気的に接続され、固定側部材２４０の端面から突出した端部は、不図示の制御回路に接続される。これにより、筐体２２０に搭載された半導体レーザや受光素子、駆動コイルユニット２５０に直接リード線を接続して引き回すような必要がなくなり、レンズ保持部材２０を円滑に駆動することが可能となる。

【００５２】次に、筐体２２０の内部の構成について説明する。図８は、本実施の形態における筐体２２０の内部構成を模式的に示す図７のＸ方向における縦断面図である。同図に示されるように、筐体２２０には、半導体レーザ素子及び受光素子を一体的に搭載した受発光素子基板７１が設けられ、その半導体レーザ素子７４（図１０参照）から射出されたレーザビームの光路上には、エッチングあるいは樹脂成形等の手段により後述の反射型ホログラム領域を設けた第１の反射面７２が設けられている。

【００５３】半導体レーザ素子７４から射出されたレーザビームが、第１の反射面７２における反射光の光路上には、第２の反射面７３が、第１の反射面７２と平行となるように設けられており、第２の反射面７３に反射した光が対物レンズ２１０を介して光記録媒体８０の情報記録面８１上に集光されるように、これらの光学部品の位置関係、対物レンズ２１０の焦点距離などが設定されている。

【００５４】なお、本実施の形態では、第１の反射面７２と対物レンズ２１０とを一体に成形した対物レンズ一体型ホログラム光学素子２１１で筐体２２０の上側開口部を密閉して内部に粉塵などが侵入するのを防止するようにしており、これにより光学系の信頼性を確保することができる。また、このように第１の反射面７２と対物レンズ２１０とを一体に成形することにより、部品点数の削減および調整工数の削減の効果も得られる。

【００５５】また、本実施の形態において、弾性支持部材２３０は、１６本の導電性部材からなるが、弾性支持部材２３０の本数は必要な信号配線数を考慮して決定すればよく、また全ての弾性支持部材２３０が電流電圧供給及び信号配線に使用される必要はない。但し、上下方向及び左右方向のバランスを考慮すると、本数を偶数又は４の倍数として上下もしくは左右に対称的な配置とすることが好ましい。

【００５６】（光ピックアップ２００の動作）次に、上記のように構成された光ピックアップ２００の動作について説明する。筐体２２０に搭載された半導体レーザ素子から射出されたレーザビームは、反射ホログラム領域を有する第１の反射面７２に反射し、続いて第１の反射面７２と平行に配置された第２の反射面７３によりさらに反射されることにより、その主光線が対物レンズ２１０の光軸にほぼ一致した状態で当該対物レンズ２１０に入射する。対物レンズ２１０を透過したレーザビームは、光記録媒体８０上の情報記録面８１上に集光される。

【００５７】当該情報記録面８１で反射されたレーザビームの戻り光は、来た光路を逆進して対物レンズ２１０を通過し、第２の反射面７３により反射され、第１の反射面７２上に形成された反射型ホログラム領域により反射回折される。当該戻り光は、反射型ホログラム領域における回折により複数の光束に分岐され、それぞれ受発光素子基板７１に搭載された複数の受光素子上へと集光し、これによりフォーカス誤差検出信号とトラッキング誤差検出信号及び情報記録信号が出力される。

【００５８】図９は、第１の反射面７２上に形成されている反射型ホログラム領域７６の形状を示す図である。同図に示すようにこの反射型ホログラム領域７６は、光記録媒体８０上の情報記録列とほぼ平行な分割線７６３により分割された２つのホログラム領域７６１、７６２を含んでおり、各々の領域で光記録媒体８０からの戻り光が反射回折される。反射型ホログラム領域７６は、反射時に回折される回折光のうち、同一領域からの＋１次回折光と－１次回折光の焦点距離が異なるように波面変換機能（レンズ効果）を持たせ、かつ、反射時の入射角依存性を考慮した曲線パターンであるとともに、ホログラム領域７６１と７６２とで回折角度が異なるように回折格子のピッチを異ならしめたものである。

【００５９】図１０は、受発光素子基板７１上に上記回折光が集光する様子を示す斜視図である。同図に示すように、受発光素子基板７１のほぼ中央部には半導体レーザ素子７４が搭載され、ホログラム領域７６１、７６２の各々において±１次回折光の焦点の間に焦点誤差検出兼トラッキング誤差検出用の３分割受光素子７５ａ、７５ｂ、７５ｃ、７５ｄが形成されている。

【００６０】フォーカス誤差検出には、±１次回折光のスポット径の変化を検出して行うスポット・サイズ・ディテクション法を、トラッキング誤差検出には、ホログラム領域７６１、７６２のそれぞれで反射された光束を、光記録媒体８０上の情報記録列と垂直方向に差動検出して行うプッシュプル法を用いる構成である。制御回路は、受発光素子基板７１上の各受光素子で検出されたフォーカス誤差の検出量に応じて、筐体２２０上のフォーカスコイル２５１に供給する電流を制御する。供給された電流に従って、磁気回路中のフォーカスコイル２５

１に電磁的駆動力が生じ、筐体２２０を光軸方向へと可動させ、光記録媒体８０上の信号面への追随動作（フォーカスサーボ）を行なう。

【００６１】上記フォーカスサーボ後、各受光素子の受光結果から検出されたトラッキング誤差の検出量に応じて筐体２２０上のトラッキングコイル２５２に供給する電流を制御する。供給された電流に従い、磁気回路中のトラッキングコイル２５２に磁気的駆動力が生じ、筐体２２０を光記録媒体８０上の情報記録列を横切る方向へと可動させる。前述の動作により光記録媒体８０の情報記録列への追随動作（トラッキングサーボ）を行なう。トラッキングサーボ後、情報記録信号を検出する。

【００６２】なお、半導体レーザ素子７４として、単一波長帯の半導体レーザ素子を用いてもよいし、波長の異なる少なくとも二つ以上の半導体レーザ素子を用いてもよい。さらには、単一の半導体レーザ素子において少なくとも二つ以上の異なる波長帯に対応する発光点を有するモノリシック多波長半導体レーザ素子を用いてもよい。光記録媒体ごとに再生波長は選択されるため、このように多波長化にすることにより多くの種類の光記録媒体の記録再生に対応することが可能となる。

【００６３】（光ピックアップ２００の製造方法）次に、第２の実施の形態に係る光ピックアップ２００の製造方法について図１１を参照しながら説明する。光ピックアップ２００の製造工程においても、筐体２２０と固定側部材２４０および弾性支持部材２３０をインサート成形により一体成形する工程を含み、第１の実施の形態とほぼ同様にして実行される。

【００６４】まず、上下の弾性支持部材２３０を構成するために、燐青銅、チタン銅、ベリリウム銅などから成る二枚の導電性の平板部材４０１ａ、４０１ｂを用意し、これを曲げ金型によるプレス加工により屈曲部２３１に相当する部分をそれぞれ下方向、上方向に屈曲させて段部４０１１ａ、４０１１ｂを形成する（工程（ａ））。

【００６５】そして、各平板部材４０１ａ、４０１ｂを、金型プレスで打ち抜いて内側の所定部分を除去し、上下の弾性支持部材２３０が周囲のフレームにつながれた状態となるリードフレーム部材４０２ａ、４０２ｂを形成する（工程（ｂ））。この打ち抜き用金型は、左右の弾性支持部材２３０がそれぞれの段部４０１１ａ、４０１１ｂにおいて互いに内側に向けて屈曲する個所を有しており、これにより屈曲部２３１が形成される。

【００６６】その後、リードフレーム部材４０２ａ、４０２ｂを、所定間隔をおいて対向させた状態で上金型、横金型、下金型で挟持して固定し（工程（ｃ）：同図では金型の図は省略されている。）、当該金型内に樹脂を注入してインサート成形を行い、筐体２２０及び固定側部材２４０内に弾性支持部材２３０の端部を埋め込むようにして一体形成する（工程（ｄ））。

【００６７】一体成形した後、筐体２２０に受発光素子基板７１や、対物レンズ一体型ホログラム光学素子２１１を挿着後、駆動コイルユニット２５０等を実装し、ワイヤボンディング、半田付け等の配線技術により、弾性支持部材２３０の筐体２２０内部の電極端子との電気的な接続を行う。次に、筐体２２０及び固定側部材２４０の外側に残留している上下のリードフレーム部材４０２ａ、４０２ｂのフレーム部分を切除し、弾性支持部材２３０のそれぞれを電気的に分離する（工程（ｅ））。

【００６８】これにより、半導体レーザ素子７４への駆動電流供給や受光素子７５への駆動電圧供給及び検出信号出力、及び駆動コイルユニット２５０への駆動電流供給を、弾性支持部材２３０を介して行うことが可能となる。最後に、固定側部材２４０上の凹部２４１～２４４に共振抑制のための図示しない粘弾性部材を充填し、ヨーク２５３を介して磁石２５４が固定された光学基台２４５上に固定側部材２４０を固定する。

【００６９】なお、上記工程（ｅ）における不要部分の除去は、光学系などの実装に先立って行うようにしてもよいし、固定側部材２４０を光学基台２４５上に固定した後で行うようにしてもよい。以上に説明したように、本実施の形態の光ピックアップの製造方法では、リードフレーム部材４０２ａ、４０２ｂを金型で固定しつつ、筐体２２０及び固定側部材２４０を樹脂で一体成形しているので、筐体２２０と固定側部材２４０との間を弾性支持部材２３０で個別に接続する工程が不要となる。

【００７０】また、成形後にリードフレーム部材の不要部分を除去するようにしているので、各弾性支持部材２３０は、均等な状態の下で筐体２２０と固定側部材２４０に連結され、それらの間での取付状態のばらつきが抑制されて、可動部材の安定した支持状態を実現すると共に生産性を向上させることが可能となる。以上のように、本発明の光ピックアップ及びその製造方法によれば、共振抑制効果が優れ、光学特性の安定した一体型の光ピックアップを製造することができ、また、生産性の向上も図ることができる。

【００７１】＜変形例＞以上、本発明に係る光ピックアップ及びその製造方法を実施の形態に基づいて説明してきたが、本発明の内容が、上記に詳細に説明した具体例に限定されるわけではなく、例えば次のような変形例を考えることもできる。

①上記各実施の形態においては、可動部材側に駆動コイルユニットを搭載し、光学基台側に磁石を搭載する、いわゆるムービング・コイル型（ＭＣ型）のアクチュエータ装置の構成としているが、駆動コイルを光学基台側に、磁石を筐体側に搭載するいわゆるムービング・マグネット型（ＭＭ型）のアクチュエータ装置の構成としてもよい。

【００７２】②上記各実施の形態において各弾性支持部材の屈曲部の位置は、均等な共振抑制効果や保持力の全

体のバランスを考えると、長手方向の同じ位置で、しかも左右上下対称に形成される方が望ましいが、読取り精度に問題のない範囲において多少のずれは許容される。また、上記屈曲部は、上記実施の形態のように塑性変形させるだけでなく、例えば、Ｚ方向に向けて湾曲させるような構成も含み得るものである。

【００７３】第２の実施の形態のように弾性支持部材の本数が多い場合には、一部の弾性支持部材について屈曲部を設けるだけでも、十分な共振抑制の効果を得ることができる。

③上記各実施の形態のようにダンパー部材を屈曲部と固定側部材の凹部の壁面の間に介在させて、屈曲部がダンパー部材を介して上記凹部に保持される構成にすることにより共振抑制の効果は、優れたものとなるが、必ずしもこのような構成にしなくても、当該屈曲部のみをダンパー部材で覆うように添着しているだけでもある程度の共振抑制効果を得られる。

【００７４】④上記各弾性支持部材の屈曲部のように、Ｚ方向に向けてなされる第１の屈曲とＹ方向に向けてなされる第２の屈曲を、長手方向の同じ位置において形成する必要は必ずしもなく、異なった位置に形成することも可能である。但し、この場合にはダンパー部材を充填する範囲が広がるので、ダンパー部材節約の観点からすれば、やはり第１の屈曲と第２の屈曲をほぼ同じ位置に形成することが望ましいであろう。

【００７５】⑤上記各実施の形態における製造工程（図４、図１１）においては、１組の金型で１個の光ピックアップをインサート成形する場合について説明したが、１組の金型内により同時に複数のレンズ駆動装置本体をインサート成形するようにしてもよい。その一例として、第１の実施の形態に係るレンズ駆動装置１００の本体を２個横方向に並べてインサート成形する場合について図１２を参照しながら説明する。

【００７６】まず、上下の弾性支持部材３１～３４を２組構成するために、燐青銅、チタン銅、ベリリウム銅などからなる二枚の導電性の平板部材３５１ａ、３５１ｂを用意し、これを曲げ金型によるプレス加工により屈曲部３１１～３４１に相当する部分をそれぞれ下方向、上方向に屈曲させて段部３５１１ａ、３５１１ｂを形成する（工程（ａ））。

【００７７】次に、各平板部材３５１ａ、３５１ｂを、金型プレスで打ち抜いて不要な部分を除去し、２組の上下の弾性支持部材３１～３４が、周囲のフレームにつながれた状態となるリードフレーム部材３５２ａ、３５２ｂを形成する（工程（ｂ））。その後、下側のリードフレーム部材３５２ｂは、図示しない下金型上に置かれ、次に弾性支持部材の延びる方向から見て左右方向より横金型を閉じると共に、中央部に中子を配置する。このとき、下金型、横金型および中子の一部は、下側のリードフレーム部材３５２ｂの一部を上下より挟持する形で接触している。続いて、横金型および中子上に上側のリードフレーム部材３５２ａが置かれ、不図示の上金型が上側より閉じる。ここにおいても同様に上金型及び横金型、中子の一部により、上側リードフレーム部材３５２ｂの一部が挟持されるようになっている。

【００７８】このように上下のリードフレーム部材３５２ａ、３５２ｂが完全に金型に固定された状態で、樹脂によるインサート成形を行い、２組のレンズ保持部材２０及び固定側部材４０を、それぞれの弾性支持部材３１～３４の端部を埋め込むようにして一体に形成する（工程（ｃ））。その後、金型を取り去って、レンズ保持部材２０及び固定側部材４０の外側に残留している上下のリードフレーム部材３５２ａ、３５２ｂの不要なフレーム部分を切除して弾性支持部材３１～３４のそれぞれを電気的に分離し、２個のレンズ駆動装置１００の本体部分が形成される（工程（ｄ））。

【００７９】このように同時にインサート成形する個数が置ければ多いほど量産が可能となり、コストダウンに資するのは言うまでもない。なお、図１２においては、レンズ駆動装置本体を横方向に並べてインサート成形したため、中子が必要となったが、縦方向（弾性支持部材の伸びる方向）に複数並べた場合には、中子も不要となり４分割金型のみにより複数のレンズ駆動装置本体を成形でき、さらに量産化に資する。

【００８０】

【発明の効果】以上説明したように、本発明に係るレンズ駆動装置もしくは光ピックアップによれば、レンズを保持する第１の部材を、同一方向に延びる複数本の弾性支持部材を介して第２の部材により保持し、当該複数本の弾性支持部材は、それぞれ、第２の部材から第１の部材に至る途中において、第１の方向に向けて屈曲する第１の屈曲部と、第１の方向とほぼ直交する第２の方向に向けて屈曲する第２の屈曲部とを有するように構成したので、第１の部材に生じようとする振動の変位を、当該屈曲部により拡大することができ、この部分にダンパー部材を添着することにより、大きな共振抑制効果を得ることができる。しかも、第１と第２の屈曲部は、それぞれ直交する２つの方向に向けて屈曲されているので、全ての方向における振動成分を両屈曲部で分担して変位拡大することができ、これにダンパー部材による共振抑制効果を作用させれば、低周波数帯域から高周波数帯域までの広い範囲での共振に対して確実な共振抑制効果が得られる。

【００８１】また、複数本の弾性支持部材は、それぞれ細長の板状であって、それらの屈曲部を含む各部の主面が、弾性支持部材の長手方向に直交する特定の一の方向に平行になるように形成されているので、当該特定の一の方向に沿って横金型を閉じる構成とすることにより、インサート成形が容易に達成され、性能にばらつきのない装置を大量に生産することができる。

【００８２】また、本発明に係るレンズ駆動装置の製造方法によれば、レンズを保持するための第１の部材とこの第１の部材を複数本の弾性支持部材を介して保持する第２の部材とからなる構造体の製造工程を、平板材を加工し、その長手方向途中に、前記平板材の主面と直交する第１の方向に向けて屈曲する第１の屈曲部と前記平板材の主面と平行であって前記長手方向に直交する第２の方向に向けて屈曲する第２の屈曲部とを有する弾性支持部材を複数本準備し、前記複数本の弾性支持部材の、前記第１と第２の部材との連結部をそれぞれ埋め込むようにして、第１と第２の部材を射出成形により形成する射出成形しているので、可動側部材である第１の部材と、固定側部材である第２の部材との間を弾性支持部材で個々に接続する工程が不要となり、上記共振抑制の効果を有するレンズ駆動装置をばらつきを生じさせずに量産することが可能になる。

【００８３】そして、１組の金型で複数の構造体を同時に成形するようにすれば、精度のよいレンズ駆動装置の量産化がより容易になる。

【図面の簡単な説明】

【図１】本発明の第１の実施の形態におけるレンズ駆動装置の外観斜視図である。

【図２】（ａ）（ｂ）は、それぞれ弾性支持部材の屈曲部において、共振が効果的に抑制されることを示す図である。

【図３】図１のレンズ駆動装置を搭載した光ピックアップの構成を示す縦断面図である。

【図４】図１のレンズ駆動装置の製造工程を示す概略図である。

【図５】レンズ駆動装置本体をインサート成形する工程を示す図である。

【図６】図５のインサート成形の工程の続きを示す図である。

【図７】本発明の第２の実施の形態に係る光ピックアップの外観斜視図である。

【図８】上記第２の実施の形態に係る光ピックアップの構成を示す縦断面図である。

【図９】上記光ピックアップの光路に設置された第１の反射面の反射型ホログラム領域の形状を示す図である。

【図１０】上記第１の反射面の反射型ホログラム領域により、光記録媒体からの戻り光が、回折により分岐されて各受光素子に集光される様子を示す図である。

【図１１】図７の光ピックアップの製造工程を示す概略図である。

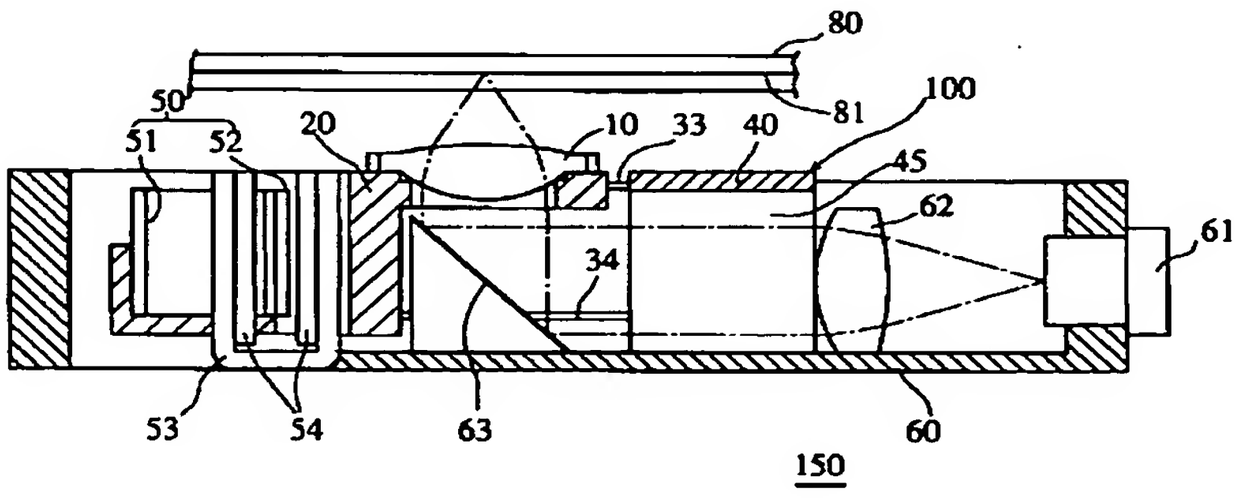
【図１２】図１のレンズ駆動装置本体を２つ並べて製造する場合の工程を示す図である。

【図１３】（ａ）（ｂ）は、それぞれ従来のレンズ駆動装置における共振防止のための可動側部材の支持構造を示す図である。

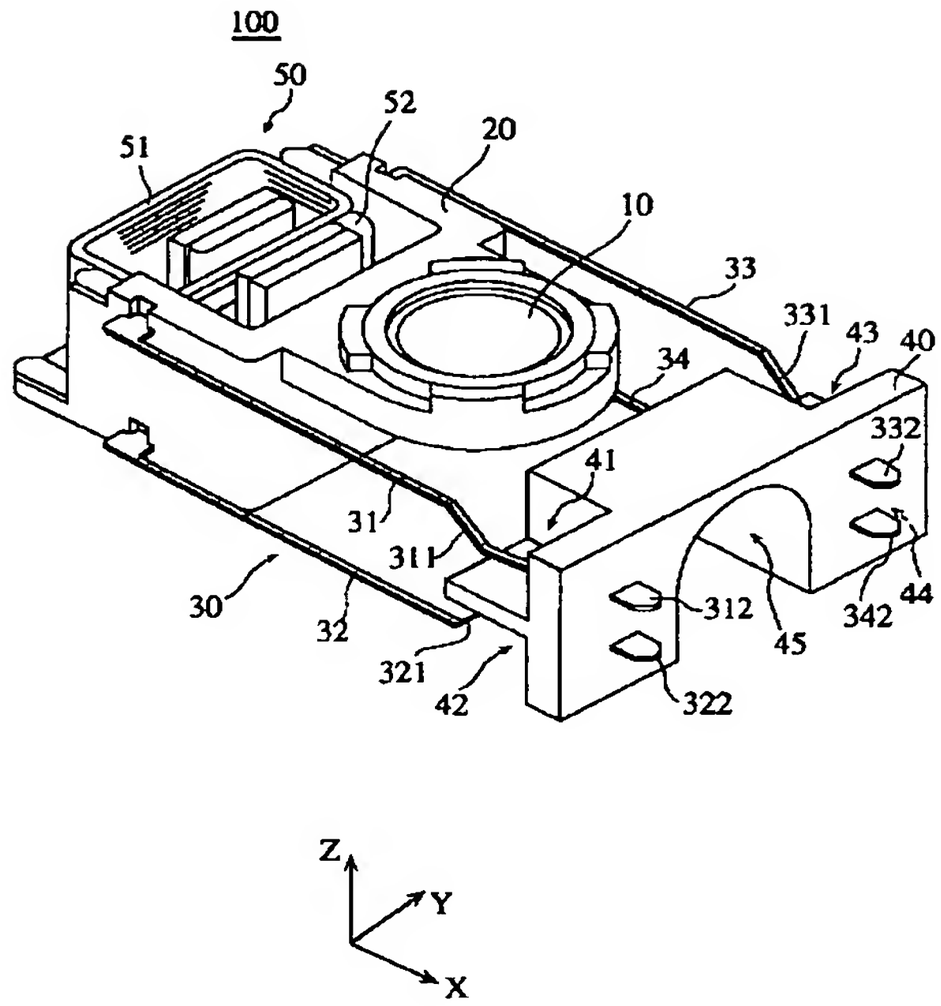
【符号の説明】

１０，２１０　　対物レンズ
２０　　レンズ保持部材
３１～３４，２３０　弾性支持部材
４０，２４０　　固定側部材
５０，２５０　　駆動コイルユニット
５１，２５１　　フォーカスコイル
５２，２５２　　トラッキングコイル
６０，２４５　　光学基台
６１　　半導体レーザ素子装置
６２　　コリメータレンズ
６３　　立ち上げミラー
７１　　受発光素子基板
７４　　半導体レーザ素子
７５ａ～７５ｄ　　受光素子
７６　　反射型ホログラム領域
８０　　光記録媒体
８１　　情報記録面
１００　　レンズ駆動装置
１５０，２００　　光ピックアップ
２１１　　対物レンズ一体型ホログラム光学素子
２２０　　筐体
３１１～３４１，２３１　屈曲部
４１１　　ダンパー部材

【図３】



【図１】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331
43
40
34
332
41
31
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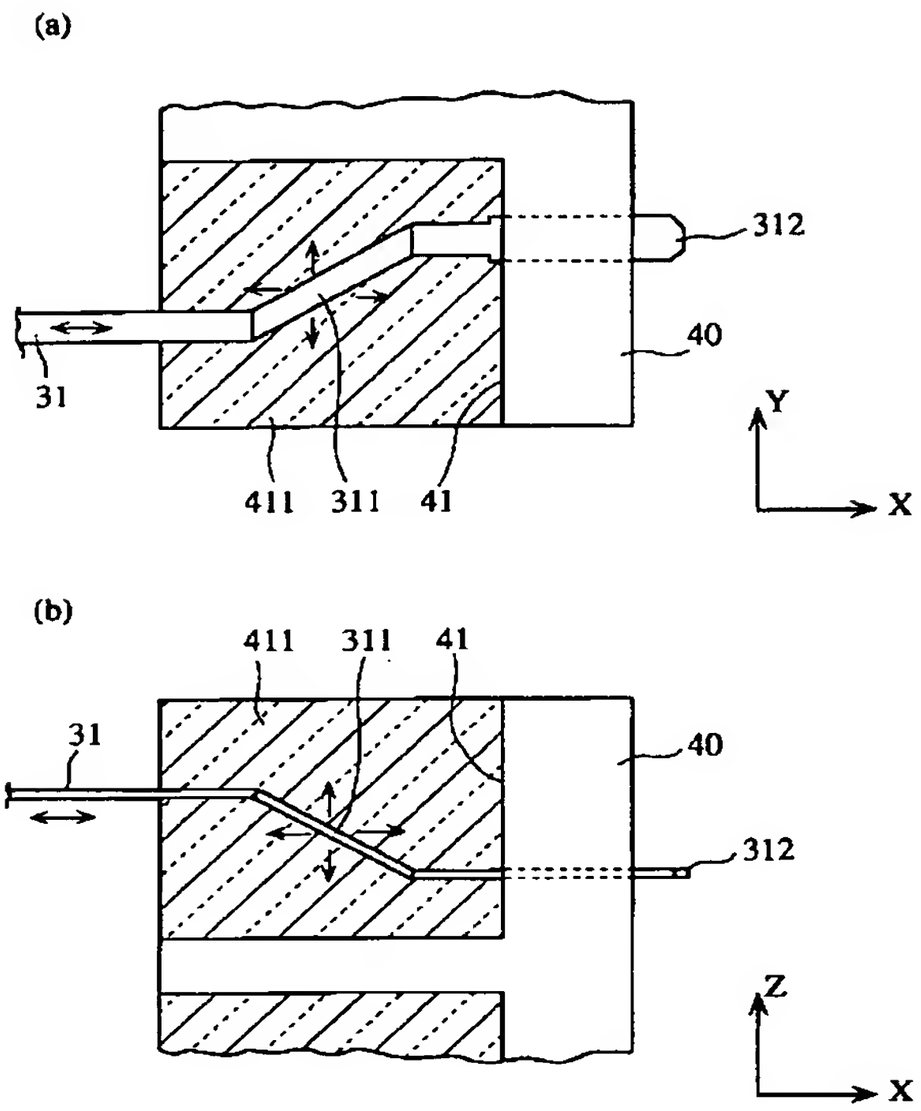
30
312
342
44
32
45
321
42
322
Z
Y
X

【図２】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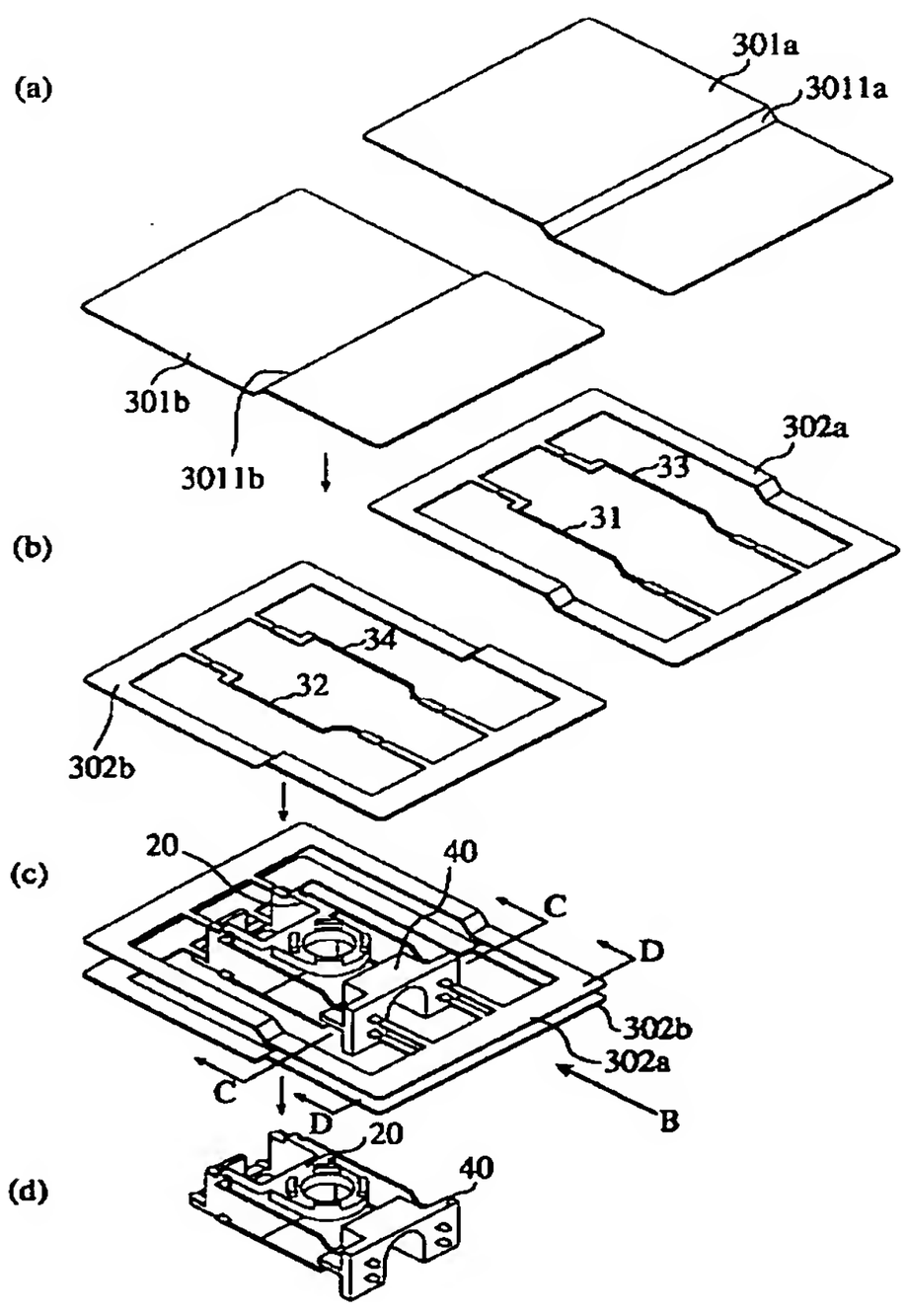
40
312
Z
X

【図４】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3011a
301b
3011b
302a
33
31
(b)
34
32
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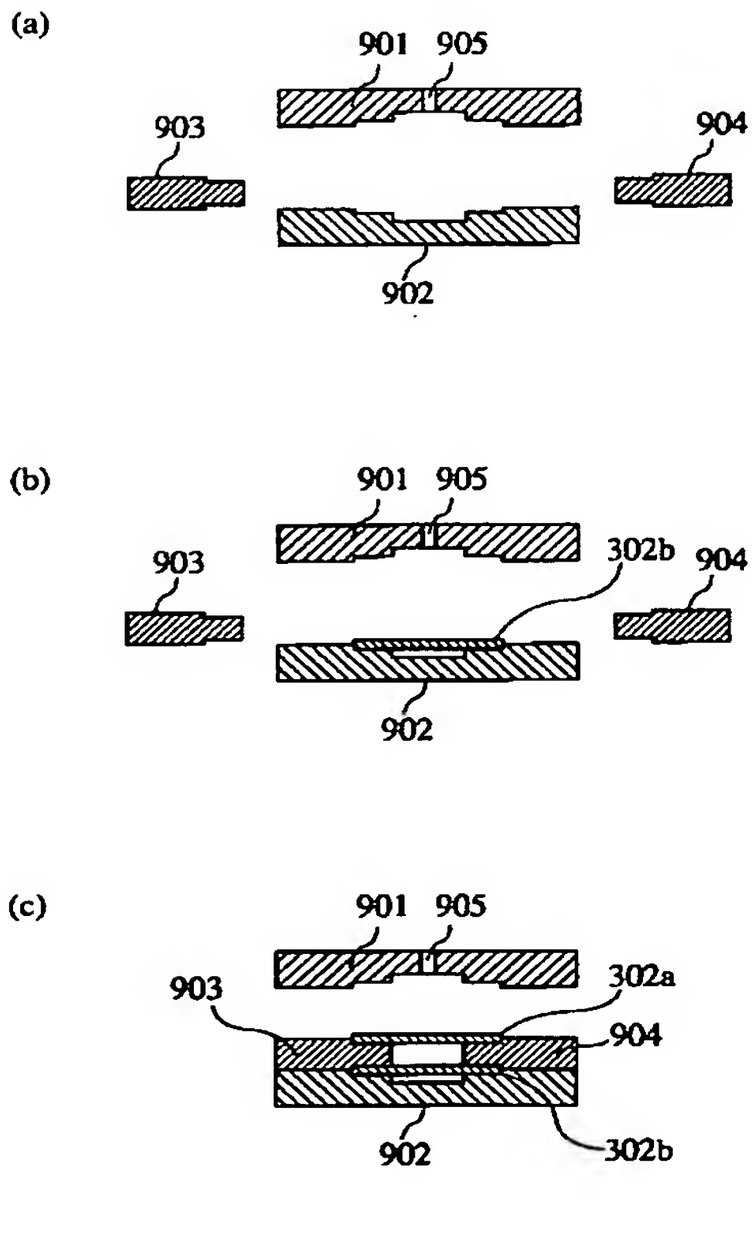
(c)
20
40
C
D
302b
302a
B
C
D
20
(d)
40

【図５】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904
902
(b)
901
905
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302b
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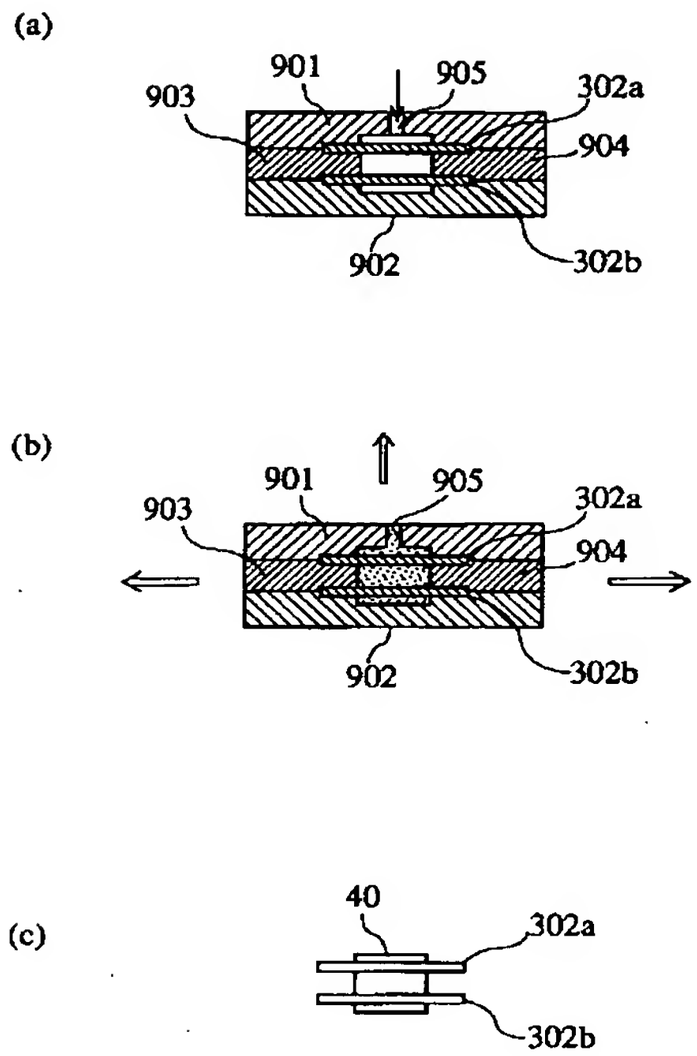
902
(c)
901
905
903
302a
904
902
302b

【図６】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(c)
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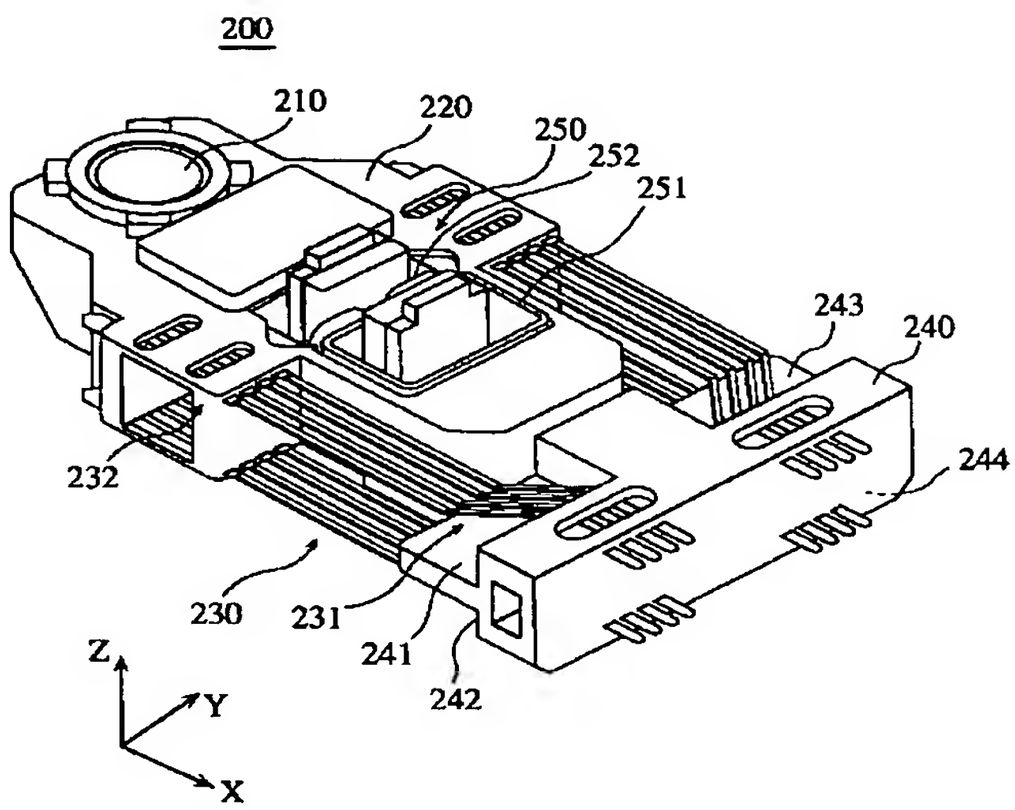
【図７】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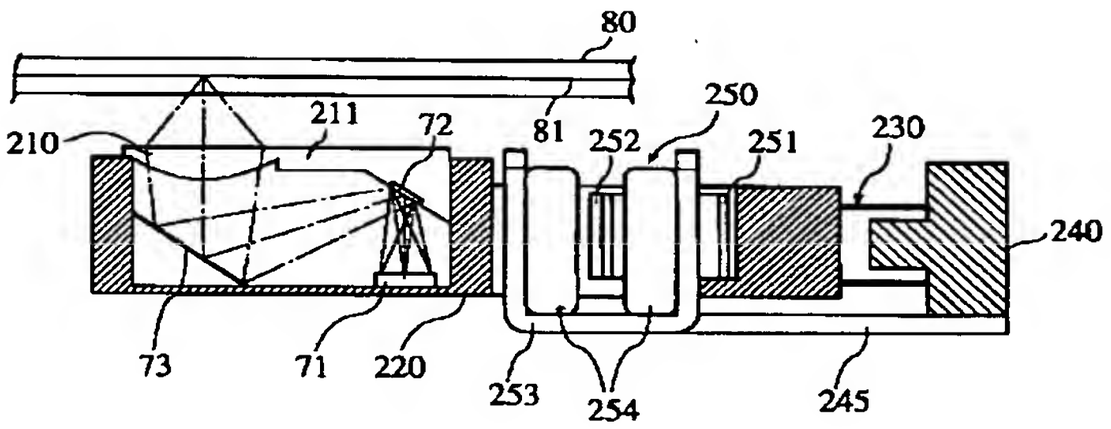
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【図９】

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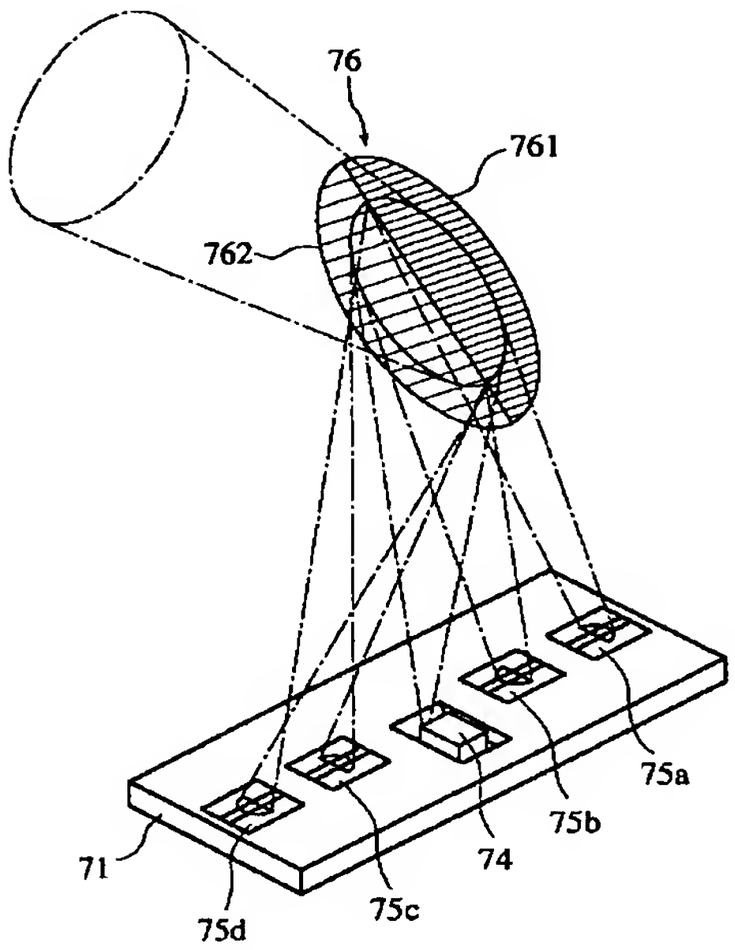
【図１０】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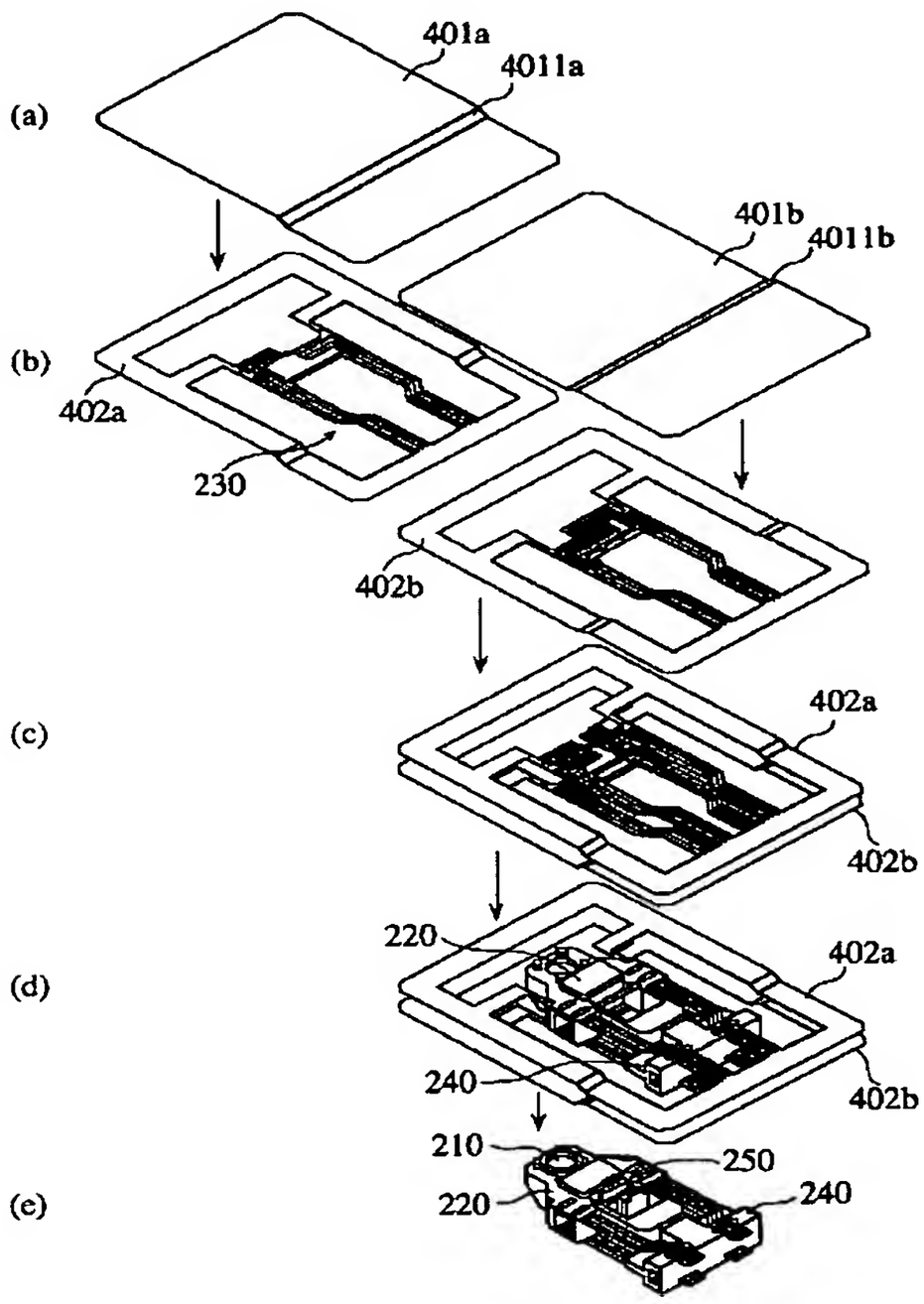
75b
75a

【図１１】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4011a
401b
4011b
(b)
402a
230
402b
(c)
402a
402b
(d)
220
402a
240
402b
(e)
210
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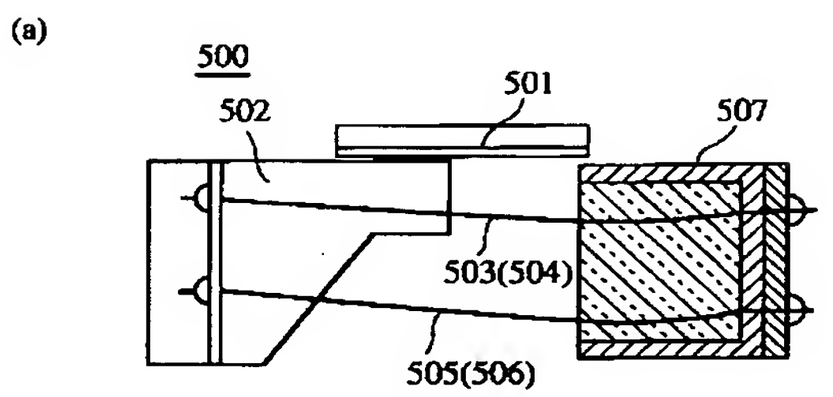
220
240

【図１３】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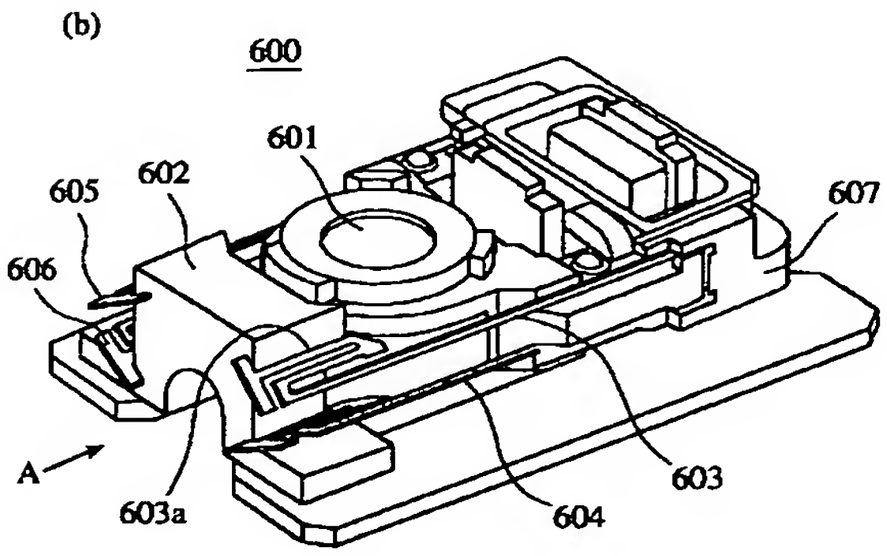
502
507
503(504)
505(506)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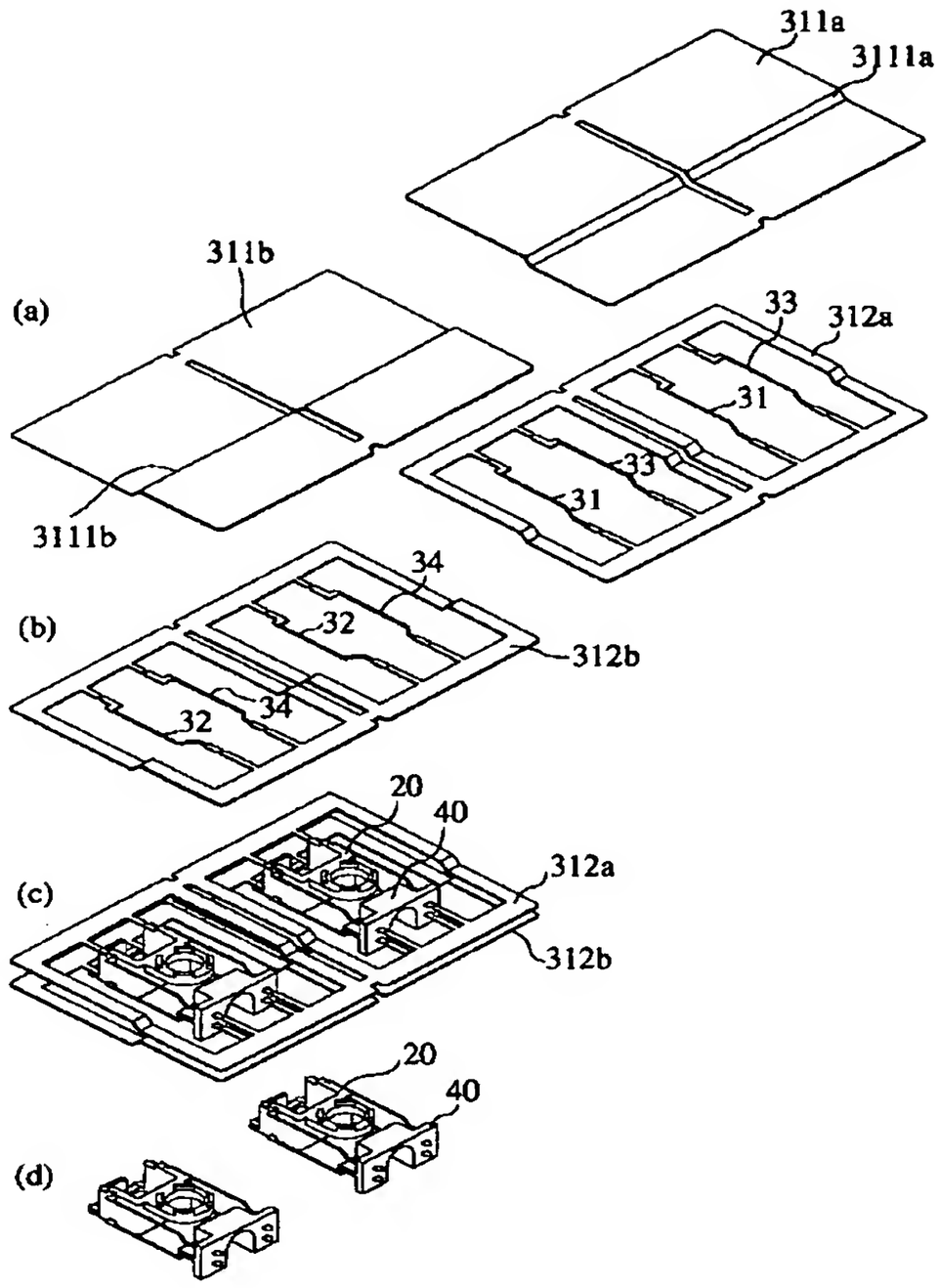
A
603a
604
603

【図１２】



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